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A Stern but Statesmanlike Budget

THE distracted state of the world is reflected in Sir John Simon's Budget, which makes demands on the taxpayer on a scale never approached before in time of peace. At the same time the steadiness with which the nation is facing an unparalleled situation is shown by its shouldering of those burdens almost as a matter of course. The Budget has been well termed the Price of National Safety. Notwithstanding its colossal provision for the defence services, it is not a war Budget. It is a Budget designed expressly to deter other nations from going to war. It gives a plain warning that Great Britain is prepared to use all her resources in the defence of her national interests. It is even more a reminder to the outside world that Great Britain's financial economy is as sound as a bell, and that the citizen whether as an individual or an industrial unit places, at this critical moment, national before private interest.

The forecast made in these columns some weeks ago that there was unlikely to be any increase in the standard rate of income tax, has been proved to be correct. The National Defence Contribution likewise remains unchanged. Our forecast was based on an unusual statement made in advance of the Budget by Sir John Simon indicating the proportions of the coming year's exceptional expenditure on armaments which he proposed to raise by taxation and by loans. On the basis then announced there should have been no need for increased taxation except on a minor scale. In the interval, however, the international situation had undergone a serious deterioration through the successive strokes against Czecho-Slovakia and Albania. The Government decided to spend even more money than it had contemplated on defence in 1939-40, and Sir John Simon explained in his Budget statement that at least another £50,000,000 would be needed under the new programme. He rightly declined to raise the whole of this amount by more loans, and announced that the taxpayer would be asked to find two-fifths of it. Accordingly instead of only having to find £4,000,000 from new taxation, he was faced with the necessity of finding £20,000,000 more.

Sir John Simon's first concern was not to discourage industry unnecessarily. The House of Commons obviously agreed with him that it would be wrong to raise the standard rate of income tax for the fourth successive year. The rate is already within 6d. of the record figure reached in the last war, and there is no sign yet that the recent declining tendency of profits from businesses has been checked. There is no question of any disinclination on the part of the business community to pay its quota up to the hilt. Indeed Sir John Simon felt it right to pay a special tribute to British industry for the success which had attended the imposition of the National Defence Contribution. The Treasury actually received from this source 10 per cent. more than the £20,000,000 estimated. He expressed satisfaction with the smooth working of this tax. Business concerns, he said, had willingly co-operated with the Revenue authorities in agreeing figures for assessment, and he acknowledged the readiness of industry in hard times to provide this special contribution towards the cost of national defence. The probability is that by leaving income tax and National Defence Contribution at their old level more money will accrue to the State in the coming financial year than in the last. It is possible that a steepening of either tax might have shown no better result. The State depends so much for its financial stability on trade and industry that it cannot afford to take any risks which might tend to stifle any enterprise promising an expansion of business.

The actual increases of taxation proposed by Sir John Simon quite properly provoked discussion because they are not to everybody's taste. If industry as a corporate factor was left untouched the successful business man will have to pay more by way of increased surtax in his lifetime, and of higher estate duties after his death. The individual taxpayer in receipt of over £2,000 a year will have to cut his coat still further, and one or two individual trades will find it necessary to make considerable readjustments in their economy. Chief of these is the motor-car industry which finds the licence duty increased from 15s. to 25s. for every unit of horse-power. This is admittedly a very steep rise, and it is justified in the main on the ground that it is a luxury tax. There may also be the thought in the back of the Treasury's mind that some of the men engaged and the materials used in the motor-car industry might be more profitably employed in the national interest for the carrying out of the more urgently important rearmament programme.

So far the increased demands have fallen chiefly on what may loosely be described as the

The amount spent on research in this country is really surprisingly small. The total expenditure, both public and private (including estimated individual research), on research of all kinds . . . is less than $\frac{1}{4}$d. for every pound sterling of the national income. On the other hand the total estimated annual return for this expenditure is of the order of 800 per cent., or 2d. per £ per annum.

—F. H. Clayton.

comfortable classes. Sir John Simon, however, was only interpreting the national sentiment in inviting every class in the community to bear its part. So he announced two additions to indirect taxation. Tobacco goes up by 1½d. an ounce, and the duty on imported foreign sugar is raised by a farthing a lb. There is nothing crippling for the "little man" in either of these increases, while he will have the satisfaction of giving his mite to swell by personal sacrifice a united national effort in the cause of peace and decent living.

Here then is a Budget statesmanlike in its conception and honourable to the nation which has already accepted it in principle. If its appearance is stern that is the aspect which British opinion wishes to show to the world at the present time. It is accepted as an integral part of a great structure which Great Britain has resolved to erect in a period of emergency. It breathes in every line the confidence of the average citizen in the strength not only of his case but of his preparations to support it. It is one of several current manifestations which should prove to the world that the British people were never more in earnest than they are at the present time. Such a display of inherent financial strength and of willing spirit of self sacrifice is one of the best arguments for the maintenance of peace which the nation could produce. This Budget then, is expressly designed to ensure the maintenance of peace over a long period.

NOTES AND COMMENTS

Working Conditions in the Modern Laboratory

EFFICIENCY, the key-note of all phases of modern industrial life, was originally restricted in application to the mechanical operations of industry. The aim was to run all plant and machinery as efficiently as possible, consideration of the personal efficiency of the operative being held a waste of time if not even exhibiting an undesirable "namby-pambiness." As recently as the early years of the present century it was thought that the longer you could work a man the better results you obtained. The inconsistent attitude, which paid close attention to the maintenance of the efficiency of the machine with regular periods of rest for overhaul and yet paid no attention to the operatives' efficiency, upon which the success of manufacture ultimately depended, has largely disappeared from present-day industry in all its branches. A similar trend has been most striking in the development of the industrial chemical laboratory. One does not have to go back many years to remember cramped, ill-lighted and ill-ventilated laboratories which too often had their origin in attempts to convert some out-of-the-way room into a mere place for the chemist to work in. Great progress has been made since those days. Comfort and convenience, essential to the efficiency of the chemist's work, are now guiding rules in planning a laboratory. Their effect can be seen in the well-lit, adequately ventilated laboratories of to-day and in the arrangement of the different services, fume cupboards, reagents, etc., so that they are readily accessible to the chemist from his working bench.

Laboratory Equipment

LABORATORY efficiency, naturally, not only depends on providing convenient working accommodation, but also on the type of apparatus and equipment with which it is furnished. Generally speaking, the best only is good enough. This does not, of course, mean that the most accurate, and accordingly the most expensive, apparatus should be provided for all operations; to provide an aperiodic balance for rough weighings would be ridiculous. But it is believed that having determined the specific requirements of an instrument for a particular purpose, the additional financial outlay on the best of the instruments available will be amply repaid in service. Whatever the technique of the individual, in quantitative work, the results rely upon accurate apparatus; one might do well to employ a coal-heaver to do micro-chemical analysis as give a good chemist inaccurate and untrustworthy apparatus. In qualitative work also much time and trouble can be quickly wasted through the breakage of cheap glass-ware and through the use of other faulty materials. It pays to use the best.

The Trade Association Movement

NO one will deny the great value of the trade association movement in the development of industry and it is good to hear tributes paid to the movement for these cannot but help to foster its growth. At the annual luncheon of the British Chemical and Dyestuffs Traders' Association on Tuesday, the Earl of Dunmore, in proposing the health of the Association, pointed out that in these days it was very necessary to have a central body which would not only be invaluable for trade consultations but also as a means of enabling Government departments to keep in touch with industry. This was the surest safeguard against any form of Government control, for which no one in industry showed any enthusiasm. Mr. Victor Blagden, President of the Association, referring to trading difficulties which had greatly increased since last year, commented on the widely-advocated suggestion that each trade should get together with a group which could voice its opinion in negotiations with other countries. He said that he had to admit that he did not like that suggestion as he felt that it meant the efficient carrying the inefficient. But if these trade combinations were to be effective, they should be as completely representative as possible. It is intended to publish the speeches in greater detail next week.

Employers' A.R.P. Code

THE Civil Defence Bill which was published a month ago requires employers of more than fifty persons in certain vulnerable areas to provide shelters and air-raid precautions training and equipment for their work-people. A Government White Paper issued this week, now gives a provisional code of standard requirements for the protection of persons working in factories and commercial buildings. Two general methods of protection are recommended: isolated shelters above or below the ground, trench shelters, or tunnel shelters outside the buildings; and shelters within the building for which there are four main types. These types are: (1) covered, trench or tunnels constructed under the ground floor of the factory; (2) existing basements; (3) suitable rooms, corridors, etc., strengthened where necessary, and (4) specially built shelters within the factory buildings, or in lean-to's. The location of shelters and their construction are dealt with in the code, as well as special shelter provision for key men and A.R.P. personnel.

Refinements in Laboratory Planning and Construction

By
C. H. BUTCHER

IRRESPECTIVE of whether a chemical laboratory is to be used for routine work or for research the planning of it is a matter which cannot be undertaken without careful consideration of features which are not immediately apparent. When the general construction of the building is left as a matter of co-operation between architect and builder, and even when an existing building is being adapted, it is still necessary to be definite upon certain points in order that no hindrance is subsequently suffered by alterations when the laboratory is in use.

Lighting, Natural and Artificial

In the matter of lighting every advantage should be taken to utilise north light; that is, all the windows of the building if possible should be on the north side. The maximum amount of natural light for a large building can be attained by glazing the north side of the roof. In this way the bad effects of direct sunlight are avoided, and this is very desirable because direct sunlight is not conducive to good analytical work. Natural daylight which reaches the interior, moreover, must receive adequate diffusion. This is best attained by using unglazed tile of a light buff colour for the wall surface. Artificial light is provided at its highest efficiency from overhead fixtures of a semi-indirect type, one 300 watt lamp being allowed for every 80 square feet of ceiling area. Artificial light, nevertheless, is best left in the hands of one of the firms who specialise in this work, because there are various features which call for experience. On the other hand, some desirable refinements may not even be apparent to the lighting specialists. For instance, lighting in the balance room becomes most ideal when obtained from movable lights that slide on a rail directly above the balance cases. The present tendency in laboratory construction is to give the maximum access to natural daylight by way of window space. This should start just above bench level and extend to within 12 to 15 inches of the ceiling. By this arrangement a very even distribution of light will be obtained if the ceiling is perfectly flat and has a soft white surface to assist in reflecting the light between the light buff coloured walls already mentioned. Walls of a light buff colour will also assist in giving the maximum effect to artificial lighting in the interval between daylight and darkness, and thus avoid any hindrance to continuous working.

Provision for the Storage of Apparatus

A laboratory which has been properly planned should have a minimum number of places for the accumulation of dirt and dust. On the other hand, it is necessary to make adequate provision for the storage of apparatus as well as reagents, because orderliness is necessary if the laboratory is to be worked in an efficient manner. This means that not only must provision be made in the form of cupboards, shelves and drawers, but these features must also be planned so that no space is lost. For instance, the storage of a large number of small items for immediate use, as and when they are needed, makes it desirable that drawers should be fitted so that partitions may be inserted in slots to divide up the drawer space in the most desirable manner and altered, if necessary, at the minimum amount of trouble. The shelves of the cupboard units are preferable as two different widths, which are also adjustable at different heights. Only by giving attention to this refinement is it possible to provide adequately for the storage of a variety of apparatus.

The ventilation of the laboratory is a matter which must receive careful attention. Provision should be made to attain ventilation without the necessary use of open windows, which always promote accumulations of dust. Artificial ventilation by means of a fan and distribution ducts is most preferable, the ducts being so arranged that direct draught or air currents near any corner of the rooms are avoided. Of course, a certain amount of ventilation can be secured by suction through the fume cupboards, but this is rarely sufficient to maintain a good work-promoting atmosphere. If forced air circulation is used it is necessary to provide means for preventing fumes permeating the whole building. Fume cupboards and hoods should have both top and bottom draught, either or both of which may be used. Fumes are best conveyed away in ducts built up from asbestos cement pipe. If necessary they should be brought together at a central point where they can be passed through a spray of caustic liqour to reduce the acid content. This treatment of the fumes is not done merely to avoid contamination of the outside atmosphere and possible damage to adjacent property, but more especially for preventing a re-entry of acid-laden air through the ventilation ducts. The removal from cupboards and hoods can be done by the suction which is created by a flame in the mouth of the fume pipe, or, alternatively, by fans which draw the fumes away. The first method is entirely satisfactory, but is now regarded as being rather old-fashioned, although it has the advantage that overhead charges are reduced because burners need be alight only upon those cupboards and hoods which are in use. In the alternative method the fan must be kept running irrespective of whether one or more of the cupboards or hoods are in use. The fan should not be placed in the actual path of the fumes, but should work in such a way that adequate indirect suction is provided and at the same time the fan is protected against injury by fumes. This can be achieved by arranging for the fan to project a stream of air into the stream of fumes, and so carry them away on the principle of an injector. For exhausting five cupboards with a total space of 150 cubic feet, a fan 30 inches diameter, rated at $\frac{1}{2}$ h.p. and driven at 500 r.p.m. will not be too large.

Corrosion of Fans in Fume-Cupboards

Proper precautions must be taken against corrosion of the fan blades. The best proposition for the direct exhausting of fumes is to instal a fan made of acid-proof stoneware, but this can be an expensive matter. In place of fan blades made of acid-resisting metal, it is possible to give protection by painting the blades with thick heat-resisting bituminous paint. Even with this precaution it still becomes necessary to inspect the fan at regular intervals, as ventilating value is a matter of concern and high efficiency cannot be attained if part of the blades have been eaten away unnoticed by acid fumes. Wherever possible fume cupboards and hoods should be so placed that valuable floor space is not lost. Gas, electricity, vacuum, compressed air and water should be provided and controlled from inside as well as outside. It is also desirable for a sink to be fitted, or other arrangements made for drainage. Vapour-proof lights are essential, as well as windows made of safety glass. Where space permits doors which slide horizontally are preferable to those which rise and fall. Sash cords should never be used owing to the risk of breakage, with a possible fatality should the laboratory worker be manipulating apparatus in the cupboard. While steel wire is satisfactory, steel chains of an easy-running type may be relied upon to give better service, provided they are coated with petroleum jelly to prevent corrosion. A fume cupboard with a very low base, i.e., only about 15 inches above floor level will be found desirable where large assemblies of apparatus must be erected under conditions which will safely dispose of the fumes which may arise. Such a cupboard should be provided with access by way of sliding doors on two sides, the structure being built preferably in the corner of one of the laboratories. When a large number of

Kjeldahl digestions have to be done, one of the hoods may be conveniently provided with a special fume duct into which the necks of the flasks can be inserted.

Bench space must be adequate and must be distributed as logically as possible so that workers are neither overcrowded nor hampered by the movements of their colleagues. Laboratory benches are now obtainable in a variety of patterns either as isolated structures or for erection against a wall. Both types have their advantages; the maximum accommodation with economy in floor and wall space is provided by a combination of the two main types. Whatever pattern is chosen, it is necessary to be sure that there is a sufficient number of sinks for the working area of the benches, and that, in the case of benches erected against a wall, the sinks are distributed at convenient distances and are adequate to serve the needs of as many workers as it may be found necessary to accommodate when the laboratory is fully staffed. Laboratory benches must be fitted with sufficient outlets for gas, electricity, vacuum, compressed air and water, and wherever water taps are present there should be facilities for drainage. For the tops of the benches a black asbestos cement asphalt composition is very satisfactory; alternatively, there is soapstone, oiled teak, lead and many other materials from which to choose. If drawers and cupboards beneath the benches are installed in the form of standard units the general arrangements can be altered at any time. Receptacles for refuse can be placed out of sight below sinks, with sheet metal panels to conceal them partly. For small rooms a bench is preferably placed along the full length of the outside wall which has window space, part of this bench being 30 inches high and the remainder 36 inches. The lower portion will be found more suitable for titration work with the worker seated upon a comfortable laboratory chair rather than a stool. Storage space for standard solutions in 5 gallon bottles could be provided in cupboards with solid doors beneath this titration bench, if the amount of volumetric analysis justifies it, and the solutions can be raised by compressed air for filling the burettes. Storage of standard solutions in this manner protects them from the light. A bench along each partitioned wall and a centre bench connected at right angles to the wall with the window space, together with a large sink at the free end, is sometimes considered an ideal arrangement, but this will depend very much upon the actual needs of workers and there are advantages and disadvantages, no doubt, in all possible suggestions.

Rooms Adjacent to the Laboratory

Special framework constructed of angle iron, with punched bolt holes at regular intervals of two inches over the whole structure, will be found convenient for the erection of apparatus which is too bulky to assemble upon the ordinary bench, i.e., in the case of gas analysis and distillation. Distilled water is best stored in a copper tank which is lined with block tin, tin-lined bronze pipes being used to distribute the water to various points in the laboratory. An electric refrigerator is ideal for the storage of inflammable liquids, and it can then be used also for general cooling purposes. Rooms for analytical work should always be kept separate from rooms in which research or special experiments are carried out. An analytical laboratory as large as possible is desirable, as this aids the work of the analyst by providing ample space in which certain types of apparatus can be set up permanently and used as often as necessary. The balance room should preferably be separate for each laboratory, even if it is only partitioned off in a relatively fume excluding manner. Benches for balances do not acquire so much risk of vibration if they are fixed direct to the floor instead of a wall. The tops should be covered with a resiliant material in order to reduce still further any risk of vibration. A separate sample room and stock room should not be overlooked, as well as a photographic dark room and a separate room for investigations involving the use of microscope, spectrometer and similar instruments. A room must also be set aside as a workshop. If a considerable amount of research is done it is preferable that the research workers should have a separate workshop complete with glass-blowing bench, vacuum pump, grinder, drill, lathe, soldering bench and racks for the storage of glass tubing. By this arrangement it is possible for the research worker to construct and repair apparatus under conditions better than those obtaining in the actual laboratory; moreover, the laboratory itself is kept much cleaner and more orderly.

Sinks and Floors

Special shelves can be fitted on brackets attached to the wall at the back of laboratory benches for use as "service" shelves, i.e., with the object of carrying the pipes for water, compressed air, gas, electricity, vacuum, and also waste. These service shelves are arranged flush with the top of the actual working surface of the bench. Sinks should be designed to fit in with the bench assembly and should be made of acid-proof stoneware, with draining boards to right or left hand according to circumstances. Drainage from sinks, including those inside fume cupboards, is preferably done by way of a separate system made of acid-resisting cast iron pipe, the joints being made with asbestos gaskets and caulked lead. Where stoneware pipe is employed, a hot-poured acid-resisting bitumen composition may be used for the joints. All fume cupboards and hoods must be adequately lighted and so placed that they are easily cleaned. Durable floors and walls are also essential. Hard finished asphaltum, about one inch thick, applied hot over concrete provides a very good laboratory floor, but there are a number of alternatives. The provision of a suitable floor is of the utmost importance. In the first place it must be waterproof and resistant, so far as possible, to the destructive action of acids and alkalis. For the comfort of the workers the floor should not be cold to the feet, and in the matter of laboratory efficiency it must be a surface which can be kept clean with the minimum of trouble. Wood floors are definitely the best, the most favourable construction being concrete faced with a good cement-sand mixture, with wood joists being partly sunk into the concrete. Floor boards are then nailed to the joists, pulled together as tightly as possible, and the crevices filled with pitch or bitumen. Such a floor will last many years without need for repair, and the surface will prove very satisfactory if treated regularly with oil or wax and dusted with a damp mop.

If floor channels are constructed along the full length of the outside wall of each laboratory, piping or any special services for experiments can be run from one room to another as desired. Where permanent benches are not contemplated similar channels can be built to serve the centre of the room so that service pipes may be brought without hindrance to apparatus which is erected some distance from the walls. Each bench in the laboratory should have its own cut-off for each service line, and cut-offs should be provided for each laboratory as a whole. Master switches and valves should be placed in positions where they can be operated easily and where they may be found without difficulty.

Colour Code for Service Lines

Risk of fire and explosion can be lessened by venting all ducts in walls and floors which have been provided to carry pipe systems. A colour code should be used for the easy and positive determination of service lines, and easily worked valves should be suitably placed to cut off any section of the laboratories. High pressure equipment must be located in such a position that it can be tested at regular intervals. Precautionary measures must be adopted for storing material which is easily inflammable. If the work of the laboratory is especially liable to fire risk, not only must fire extinguishers be provided, but also quick acting showers or fire blankets and a suitable system of devices to give alarm. Injury in normal working or under conditions of panic from mechanical causes can be minimised by good lighting, especially in corridors and stairways, within the cupboards and hoods, and adjacent to machinery. The position of the doors in each laboratory relative to adjacent doors is also important.

A Review of Recent Advances in Spectrographic Apparatus

By

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DURING the past few years an unusually large number of books and papers have been published on the subject of spectro-analytical practice. Coincident with this, the leading manufacturers of the necessary apparatus have put forward great and successful efforts to meet the demands of what has become an essential addition to research and industrial laboratories. That there is still much leeway to make up admits of no doubt, but it is certainly a fact that the great industrialists are becoming more and more spectroscopically conscious as time goes by. Should any reader doubt this statement let him peruse the pages of a small book recently reviewed in these columns. I refer to Mr. A. C. Candler's "Spectrographic Analysis in Great Britain." In this work details of what is being done throughout the length and breadth of the land will be found. The question will then arise in the minds of many "why is not the spectrograph as common in works laboratories as, say, the saccharimeter in sugar factories?" The answer is probably two-fold. In the first place there is the initial cost of the required apparatus which, because of the necessary workmanship, must always be fairly high, and second the somewhat specialised technique required in the analytical procedure. It should, however, be remembered that the first difficulty is more apparent than real because the apparatus lasts a lifetime, and therefore the *yearly* cost is slight. As regards the technique, the manufacturers here mentioned are only too pleased to initiate the newcomer into the mysteries of spectrographic procedure. Personally I can assure any chemist that the work is a matter of delight and not such as to cause the slightest apprehension. Having said so much I think it is well to allow the firms represented in this review to speak for themselves. To this end the notes which they have kindly furnished are put forward without comment. Prices and further information will, of course, be furnished on application.

Spectrometric Apparatus

(Bellingham and Stanley, Ltd.)

The application of spectrometric methods of analysis and examination to industrial problems has, to a very large extent, influenced the design of the apparatus, and instruments are now so constructed that adjustments are largely eliminated.

In general, both spectrographs and spectrometers are of simple design. The optical elements and all mechanical movements are enclosed. The general finish is such that the apparatus can be easily cleaned and kept free from dust. Lacquer and sharp corners and crevices to collect dirt and dust have disappeared, and the removal of superfluous ornamentations have produced what might almost be termed *streamlined* instruments—simple, pleasing and, above all, efficient.

An industrial establishment which instals a research laboratory, does so with a view to increasing profits, either by improved methods of manufacture or by producing an article of better quality. The cost of the necessary apparatus to do this, spread over a number of years, is comparatively small compared with other expenses. Industrial requirements demand that the apparatus chosen for research or for routine control should be suitable for dealing with the problems which are more likely to be encountered.

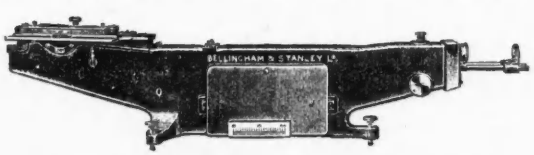


Fig. 1. A "medium dispersion" spectrograph.

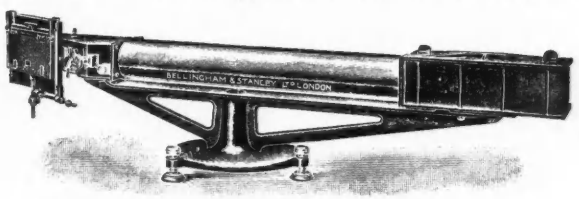


Fig. 2. Spectrograph for more complex spectra.

In the case of spectrographs, it may be necessary to analyse metals, some of which give complex spectra, such as iron, molybdenum, tungsten, etc., while others give simple spectra, as for example zinc, aluminium, cadmium, tin and other alloys. A spectrograph giving high dispersion is very costly, and an apparatus of medium dispersion will usually fulfil the requirements. Photographic plates used in the photography of the spectrum are now of such fine grain and quality, that providing the resolving power and definition given by the instrument are good, the spectrograms can be easily enlarged.

A spectrograph which may be termed of medium dispersion is illustrated in Fig. 1. This instrument will deal in a most efficient way with the analysis of such metals as zinc, copper, tin, silver, lead, aluminium, cadmium, etc., but for the more complex spectra, as instanced above, an instrument such as that shown in Fig. 2 is more generally useful. Unfortunately, the length of spectrum is such that possibly three or more exposures are necessary. In practice this is not very difficult, as the movement necessary to prism and lens is practically automatic, and the exposures can be made in a short period of time.

Whether a medium or high dispersion spectrograph is used depends, as stated, on the nature of the work in progress, but with all types of instrument it is necessary to interpret the

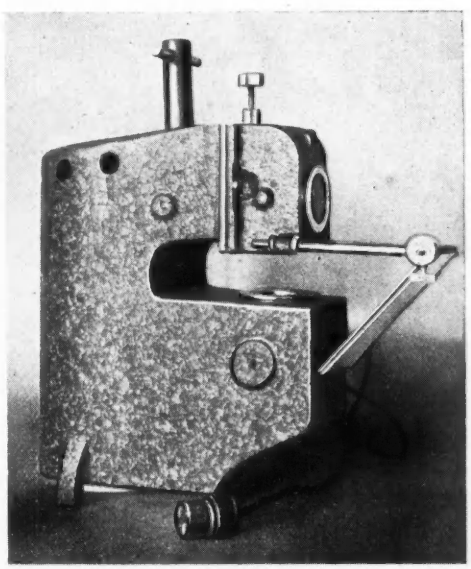


Fig. 3. Projecting apparatus for enlarging photographic spectra.

spectrum obtained, and by far the most satisfactory way is to enlarge the photographic spectrum to a size which can be easily examined. The projecting apparatus, Fig. 3, has been specially designed for this purpose. The instrument consists of a high power projection lamp and a photographic projection lens of short focus but free from distortion. When required for spectrometric measurements a slide mounting is attached. The lower slide is capable of travel over the full length of the photographic plate, i.e., about 10 in. The upper slide has a slow motion by means of an accurate micrometer screw over the distance of about 1 in., so that a group of

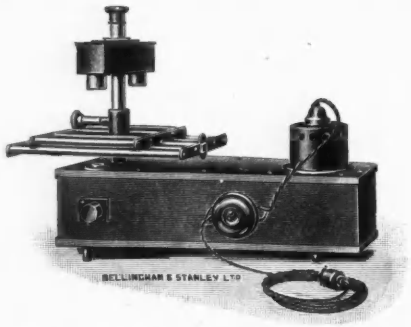


Fig. 4. Optical comparator for comparing spectra with standard spectrum.

spectrum lines over this distance can be accurately measured. When examining or comparing spectra, the image is reflected down by means of a mirror on to a white surface on the table on which the instrument stands. On this white surface a scale can be drawn of large size, from which wavelength measurements can be determined to an accuracy of about a single unit.

The same instrument serves admirably as a non-recording micro-photometer for the density measurement of spectrum lines. When required for this purpose, a photocell mounting is attached and the reflecting mirror removed. The optical system is then arranged so that an image of the spectrum line in question is formed on a slit immediately in front of the photocell. By turning the micrometer screw on the upper

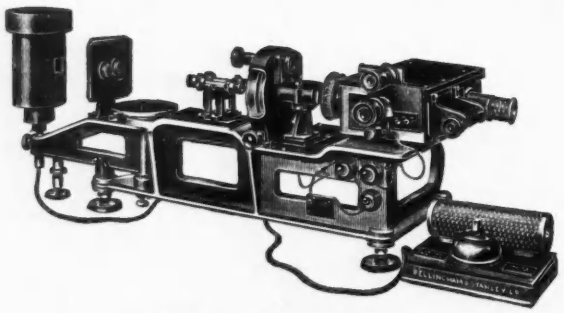


Fig. 5. Spectrophotometer.

slide, each spectrum line may be brought in turn to the slit in front of the photocell, and by means of a suitable mirror galvanometer the actual density measurement can be determined.

In some cases when it is necessary to detect the presence or absence of an impurity in a substance, the spectrum should be compared directly with the spectrum of the element in question. Then an optical comparator is used, in which a suitable prism system brings the known and unknown spectra from two photographic plates in sharp contact, and the presence or absence of a spectrum line in the unknown spectrum can be seen at a glance. This method, of course, necessitates the use of standard spectrum plates obtained with materials the purity and composition of which are known with certainty. A simple type of comparator for this purpose in shown in Fig. 4.

For quantitative and qualitative chemical analysis, emission spectra either from the arc or spark are more generally used, but a considerable amount of work is now being carried out with the aid of absorption spectra for the analysis of metals.

The Spectrophotometer

For this purpose, a spectrophotometer designed for use over the visible range of spectrum is employed, so that absorption bands due to metallic salts can be isolated and measured. Such an instrument is shown in Fig. 5, and consists of two principal units, namely, a spectrometer which serves to produce the spectrum and to give an indication of the wavelength of the light being used, and a photometer which enables the two comparison beams to be compared. One of the beams from the light source passes through the solution and may transit only certain regions of the spectrum, while the other beam passes through a Nicol prism system, one Nicol being rotated as desired to cut down the amount of light transmitted. This Nicol is mounted in a circle, which in the case of the Bellingham and Stanley, Ltd., instruments is of glass. The reading on the circle as it is turned is seen by a low power telescopic system placed immediately above the eyepiece of the spectrometer.

When desired, the photometer unit can be moved out of position so that the light passing directly through the solution can be examined and measured by a photocell attachment which is mounted in place of the eye piece on the spectrometer. When used in this way the general procedure is to measure the amount of light passing the solution, and then that passing the solvent.

The same instrument serves perfectly for measuring the light absorbed or reflected from opaque materials, when the light source is moved round to the necessary angle to illuminate the specimen.

Spectrochemical Apparatus and Methods

(Adam Hilger, Ltd.)

Emission Spectrum Analysis.—The main requisite for spectrochemical analysis is the spectrograph itself and practically every maker in the world has now adopted one or both of the two sizes of quartz spectrograph introduced by Hilgers about 1909 and 1911, the "medium" and "large." In their latest medium quartz spectrograph (Fig. 6), the firm have produced an instrument in which, for the first time, the focal surface is so flat that ordinary full thickness photographic plates can be used. This is of importance if only for the sake of economy. The improvement has been secured simultaneously with a further improvement of definition throughout the entire range of the spectrum.

The advance in the *large* quartz spectrograph has been perhaps more important and certainly more spectacular. The dispersion of the *large* quartz spectrograph, it must be explained, is essential if the user is to be able to attack every problem of spectrochemical analysis that comes before him. To give one example, steels, and in particular alloy steels,

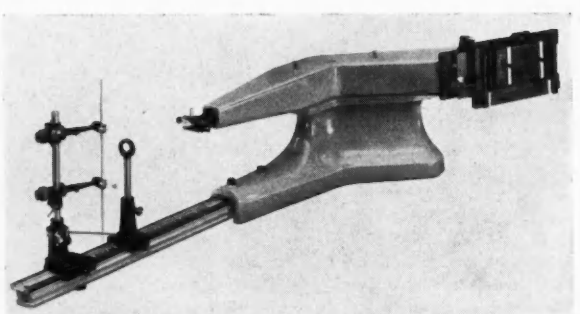


Fig. 6. Hilger medium quartz spectrograph.

have such complex spectra, that the use for their analysis of a medium dispersion quartz spectrograph is attended with difficulties and restrictions arising from the insufficient dispersion.

Sparking Equipment.—As regards the auxiliary apparatus, an item of importance is the sparking equipment, the spark (rather than the arc) being now in general use for quantitative analysis, though by no means universally so. The Hilger laboratory by studying the simple resonance sparking circuit (*The Practice of Spectrum Analysis,* F. Twyman and others, 6th edition, p.20) over a considerable number of years, has been able to secure an accuracy not less than that obtained with the most complicated and delicate systems which have been tried (notably in Germany).

Short Exposure with Hilger Sparking Equipment

To take one example, it is customary for workers with the Feussner spark to take (including the pre-sparking period) 5 to 7 minutes in obtaining a single photograph. In English laboratories using the Hilger sparking equipment an exposure of from 10 to 20 seconds suffices—and using the specified routine in the preparation and use of the electrodes no pre-sparking at all is required, while the accuracy achieved is in no way inferior.

For the spectrochemical analysis of steels and most of the heavier elements which have complex spectra, Adam Hilger, Ltd., have long recommended the use of the large Littrow quartz spectrograph which has so great a dispersion that the complete spectrum requires three or four separate exposures on a ten inch plate. A disadvantage of such instruments previously lay in the necessity for making three separate adjustments for each different section of the spectrum. This drawback has been completely eliminated by the introduction of the Hilger fully automatic large quartz spectrograph (Fig. 7) in which a single handle gives continuous control of all the adjustments of the optical system, and a wavelength scale indicates the exact range of spectrum included on the plate at every position of the control. At the same time the whole design of the instrument has been overhauled so that it is now suitable for routine work in industrial laboratories.

The latest phase in the improvement of spectrographic equipment is the development of the fully automatic quartz spectrograph (Fig. 8) by adding a glass optical-train so arranged that a simple mechanism can bring either system into use. Each system is controlled automatically by means of an independent set of cams. Thus in a few minutes an operator can photograph the whole spectrum of a substance on one plate, and add the visible portion taken with the greater dispersion given by the glass system.

Apparatus for Absorption Spectrophotometry

Spectrophotometric Equipment.—As in the case of emission spectrum analysis and its associated equipment, the last few years have seen a sudden and rapid increase in the available apparatus for absorption spectrophotometry. The importance of the absorption of substances for light was early realised as a function, not merely of their colour, but also of their constitution, and investigations were carried out by relatively crude methods until the advent in 1911 of the Twyman sector photometer. This put a powerful new tool into the hands of the physical chemist which enabled him, for the first time, to make accurate and systematic measurements of absorption curves in the ultra-violet part of the spectrum.

In 1931 the original producers of the Twyman instrument brought out a new photometer whose accuracy and simplicity were a great advance on previous methods. This instrument known as the Spekker ultra violet photometer has a simple shutter which can be progressively interposed in a light path of uniform flux to reduce its intensity in a known degree comparable directly with the absorption of the substance under study. Shutter adjustment is performed by a screw motion controlled by a calibrated helical drum with a long and easily

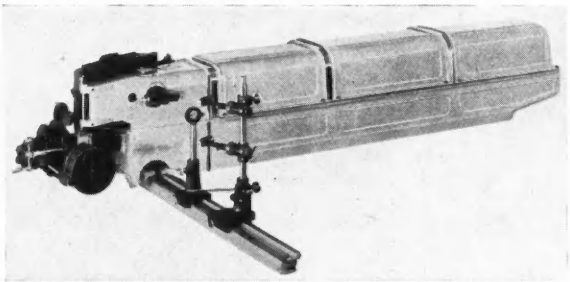


Fig. 7. Fully automatic large quartz spectrograph.

read scale of densities. The incorporation in the instrument itself of the spark light source and the provision of a simple coupling to the collimator of the quartz spectrograph, very greatly simplified the procedure of aligning the apparatus.

Still more recent improvements in the design of spectrographs by the attachment of a rigid, accurate, optical bench (the Hilger Barfit instruments) have removed the last difficulty from alignment since it is now only necessary to set the photometer on the bar and clamp it, when it is immediately in complete adjustment.

Ultra-violet absorption spectrograms are usually taken with spark sources yielding very complex spectra which approach continuity. In recent years improvements in this direction have included the use of tungsten-steel electrodes for general purpose, and, on the suggestion of Dr. S. Judd Lewis (*Chemistry and Industry,* June 2, 1933), uranium electrodes for special purposes which require an even more nearly continuous spectrum.

Hydrogen Discharge Tubes for Continuous U.V. Spectra

Actually continuous ultra violet spectra are necessary wherever there is much fine detail in absorption spectra and, besides the cumbrous and elaborate under-water spark, several forms of high current hydrogen discharge tubes have been introduced for this purpose. Such tubes pass about 2 K.V.A. at from 2,000 to 4,000 volts.

Unless these sources are excited with continuous current from a high voltage generator their intermittency causes difficulties from stroboscopic effects when revolving sector apparatus is used. In the types so far produced the emitted pencil of radiation is far from being uniform in distribution, and this is a disadvantage when working with photometers of the Spekker type. It can, however, be overcome by causing the beam to oscillate continuously over such an angle that the whole aperture of the instrument is covered in its sweep and the variations are, in effect, integrated at all points provided a suitable period is adopted. The device for

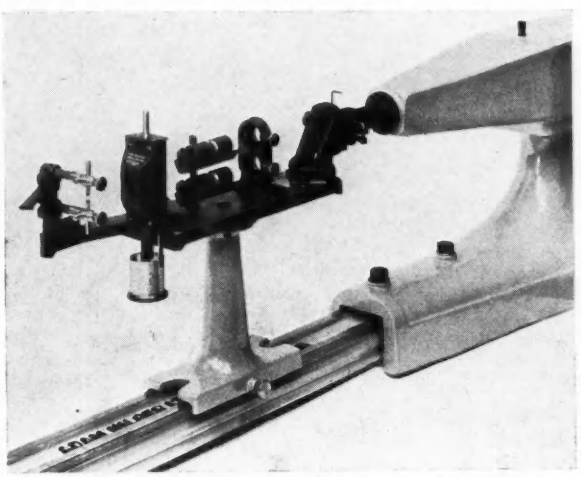


Fig. 8. The Spekker ultra-violet photometer.

accomplishing this is sold under the name of the Rocking Mirror.

The study of fine detail in absorption spectra has been further advanced by the Holiday logarithmic cam (E. R Holiday, *Journ. Sci. Inst.*, 1937, *14*, 166) a device which causes the photographic plate in the spectrograph to move at a logarithmically increasing speed in a direction perpendicular to the spectrum. The "wedge spectra" which result, indicate the positions of absorption bands and quantitative measurements may readily be made by means of a microphotometer.

An important class of substances for study by their absorption spectra is liable to undergo photo-chemical changes in the course of exposure. Various attempts have therefore been made to shorten the necessary time of exposure. The Spekker photometer in itself gives considerable improvement in this direction, but the most notable commercial development in this way is the notched echelon cell (B.P. No. 393,648; Twyman, Spencer and Harvey, *Trans. Opt. Soc.*, 1931-32, *33*); a device which enables absorption spectrograms through ten different lengths of solution to be taken in juxtaposition with ten comparison spectra for similar lengths of control liquid reduced in a known degree by a revolving sector. The single exposure may only occupy twenty seconds. The little cells used in this apparatus are remarkable examples of the optical instrument maker's skill. The method is recommended only for use with very sensitive substances. Wherever its use is possible the Spekker photometer is recommended on account of its superior accuracy of measurement.

Examining the Negatives

Improvements have also been made in methods for examining the negatives obtained in absorption spectrophotometry. Comfort in examination is secured by the use of a spectrum projector of low magnification such as the Dekkor spectrum projector (C. F. Smith, *Journ. Sci. Inst.*, 1935, *12*, 288), a completely self-contained unit. Accuracy, particularly when continuous spectra have to be matched, is improved by the use of the matching microphotometer, a development of the Hilger non-recording microphotometer (D. H. Follett, *Proc. Phys. Soc.*, 1935, *47*) in which the upper and lower halves of an absorption spectrum pair are projected on separate photocells connected in opposition to a galvanometer whose zero reading indicates equality of the halves.

Photoelectric methods of spectrophotometry are attractive, but unless very carefully designed can yield seemingly accurate but actually spurious results. One of the best methods, developed by von Halban, has been incorporated in the Hilger photoelectric photometer (*ibid.*, 1934, *46*, 499); which used in conjunction with a good double monochromator, such as the Uvisir double monochromator, is capable of giving accurate absorption measurements throughout the visible and ultra-violet parts of the spectrum.

Before leaving the subject of ultra-violet spectro-photometry we must look in passing, at a special instrument which resulted from a special need; the Vitameter A for the determination of the concentration of vitamin A in fish liver oils and similar materials. In effect this is a simplified ultra-violet spectrophotometer, adapted only to the measurements of absorption at a chosen part of the spectrum and operated visually. The region chosen is near the peak of the absorption curve of vitamin A. A recent development is the addition of photographic means of recording the results.

Developments in apparatus for visual spectrophotometry have been fewer and less remarkable on the whole, possibly because the original development of visual apparatus is attended with fewer difficulties than photographic methods. Two important developments are worth noting. The first is the very considerable improvement in ease of adjustment brought about by the incorporation of the Hilger standard accessory bar in the construction of visual spectrophotometers. It is now possible to assemble the usual units of a Hilger-Nutting spectrophotometer on such a bar in a few seconds with perfect confidence in correct alignment. The second is the introduction of a new polarising system for the photometer portion of visual spectrophotometers which besides increasing the accuracy of reading at high densities eliminates most of the trouble that may occur from the presence of stray light.

Quantitative Spectrum Analysis of Metals

(Carl Zeiss (London), Ltd.)

Qualitative spectrum analysis has already been in use in many works for a considerable time. Accurate tables and working directions for the determination of the various elements had carefully been worked out so that the application of this spectrographic method in practise for routine work was a comparatively easy matter. *Half quantitative* spectrum analysis, that is, the classification of various alloys of equal qualitative composition but widely varying in concentration, has been in constant use for many years.

The conditions were quite different for the *quantitative* spectrographic analysis of high accuracy, which means, generally speaking, that the error is smaller than ± 10 per cent. of the concentration to be determined. It is only during the last few years that detailed working directions for the quantitative determination of the various elements have been supplied with a spectrographic equipment, but since this has been possible the application of quantitative spectrum analysis has rapidly increased for routine work in co-operation with chemical analysis. A number of papers have been published describing the good results obtained with this method in iron, steel and light metal working industries.

The principles of the method recommended are as follows: two electrodes of specified shape are cut out of the material to be examined and then clamped in the electrode holders of a sparking stand. An electrical discharge is produced between the two electrodes by means of the Feussner sparking apparatus. The light emitted by the spark is concentrated on the spectrograph by means of a suitable optical illuminating system and the resulting spectrum is photographed. The density of the spectrum lines is measured with a microphotometer. The spectra of two standard samples of known concentration are photographed under exactly the same conditions. By plotting the density ratio of two lines against the two known concentrations a calibration is obtained from which the concentration of the unknown sample can be read off.

A Complete Spectrographic Equipment

A complete spectrographic equipment comprises the following parts (see Fig. 9):

1. The Feussner sparking apparatus with controlled discharge. The electrical conditions are absolutely fixed and they are independent of the condition at the electrodes.

2. The sparking stand which holds the two electrodes made out of the material to be tested. This stand is provided with fine adjustments for the following movements: (a) the upper electrodes in the direction of the optical axis of the illuminating system, (b) each electrode laterally, (c) distance of the electrodes against each other, and (d) raising or lowering of both electrodes together.

3. Special projection system which controls in a simple

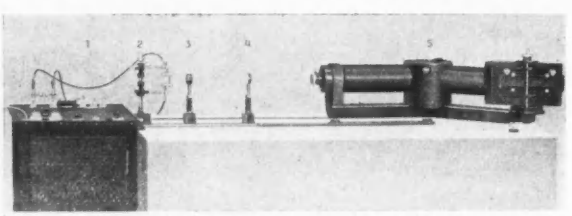


Fig. 9. Zeiss spectrographic equipment.

but very accurate way the correct distance and position of the electrodes.

4. Special illuminating system which ensures that the whole length of the slit of the spectrograph is equally illuminated and that all light falling upon the slit reaches the photographic plate. These conditions are an absolute necessity for the correct measurement of the density ratio of two spectrum lines.

An intermediate image is formed on a wide diaphragm cap. This allows the correct illumination to be easily controlled at all times, even during the exposure. Further, certain parts of the spark can be cut out from the illumination of the spectrographic slit. This is of importance because experience has shown that with some alloys better results are obtained if the electrodes are cut out and only the light coming from the centre of the spark is used.

5. Spectrograph.—For the examination of lead and light metals, that is, for spectra which have not very many lines, the linear dispersion of the Universal spectrograph with 13 × 18 cm. plates is quite sufficient, whereas for iron and steel the large quartz spectrograph is preferable. The field of view of both spectrographs is perfectly flat so that plates of the usual thickness can be used. Both spectrographs are provided with a wavelength scale which is printed on each photographic plate above the spectrum.

For measuring the density of the spectrum lines, a spectrum line photometer is used. In this instrument the plate with the spectrum is placed on a vertical stage which is adjustable in two directions vertical to each other. The line of the element to be determined is projected on a photo-electric cell. A slit in front of the photo-electric cell ensures that only the light transmitted by the spectrum line falls upon the photo-electric cell. A galvanometer which is connected to the photo-electric cell registers deflection, the numerical value of which is read off from the scale by means of a luminous pointer. The Köhler illumination system ensures that no stray light from parts in the neighbourhood of the plate can reach the photo-electric cell and thus cause false results.

A quantitative spectrum analysis of high accuracy does not require knowledge of the complicated physical process of the electrical discharge between the electrodes. It is only necessary to find such conditions where this physical process is absolutely constant for each measurement. This is the purpose of the detailed working directions which are now available for the examination of aluminium and aluminium alloys, iron and steel, lead alloys, zinc alloys and copper alloys. The following conditions are laid down in such working directions: size and shape of the electrodes, position of the lenses of the optical system for the intermediate image, size of diaphragm on which the intermediate image of the spark is formed, capacity and self-induction of the sparking apparatus, the time of the preliminary sparking, suitable pair of spectrum lines, exposure time, and illumination of the sparking gap with a mercury lamp.

H. Kaiser recognised that the accuracy of quantitative spectrographic analysis can be determined in itself independently of the accuracy of the chemical analysis. For this purpose a very large number of spectrographic determinations were carried out on one and the same sample. The mean error in per cent. of the concentration to be determined was found to be as follows:

For Sb in Pb ± 1.1 per cent.
,, Sn ,, ,, ± 1.7 per cent.
,, Cd ,, ,, ± 2.3 per cent.

Similar examinations have been carried out by other observers on other metals, such as iron, steel, aluminium and light metal alloys. H. Kaiser also made a very careful examination of the influence of the various errors on the final result of a concentration. These errors arise from the density measurement of the spectrum line, the plate, the sparking apparatus, and the sample.

Platinum in the Laboratory

By
C. A. H. JAHN

MUCH has been written during recent years on the applications of platinum in modern industry and many chemists have directed research towards the possible discovery of a base metal or alloy which could be substituted for platinum, since it is obviously of fundamental importance to manufacturers that production costs should be kept as low as possible. It is true to say, however, that in spite of much intensive research, very little headway has been made in this direction, due no doubt to the extreme difficulty in obtaining from other metals of less pecuniary value a combination of advantageous properties which even approaches that possessed by platinum.

The principal properties of platinum which are responsible for its wide application in industry and which make it virtually indispensable in the laboratory are:—

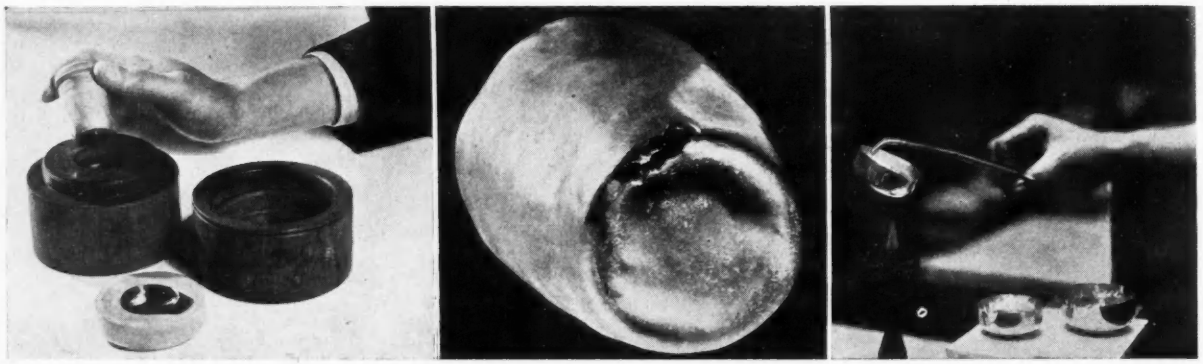
(a) High melting point (1,773° C.).
(b) Resistance to oxidation at high temperatures.
(c) Catalytic activity for the promotion of chemical reactions.
(d) Immunity from attack by most mineral acids.
(e) Resistance to attack by a wide range of fusion mixtures.

It has become increasingly evident that the exacting demands made upon the metal by the chemical and electrical industries can only be fulfilled by the use of platinum of the highest purity obtainable. Many years of work by platinum refiners have been devoted to this end and industry is now reaping the benefit of their labours to the extent of being able to acquire platinum of 99.99 per cent. purity as a standard product. Platinum is never found in the pure state, but always associated with other metals of the platinum group. Chemists whose analytical work has involved the separation of the platinum group metals from one another and from base metals, will appreciate to the full the great advance that has taken place in refining processes to produce platinum and its precious metal associates in such a high state of purity.

Pure platinum apparatus is of particular value to chemists engaged upon research in the manufacture of glass, where extremely careful analysis is necessary for the determination of minute quantities of impurities or of synthetic compounds in the material undergoing examination. The fusion temperatures of a number of these glass products are in the region of 1,400° C. and platinum has proved the only satisfactory metal for this highly specialised work.

In the laboratory, the use of platinum apparatus has made possible the quantitative determination of a number of elements and chemical compounds, which by reason of their corrosive properties might still have remained in the realms of qualitative analysis, but for the application of a metal exhibiting such properties as those provided by platinum.

The chemist no doubt appreciates the value of platinum ware though there is a tendency, as with all things which eventually become commonplace, to take for granted all the advantages which are derived from the varied laboratory applications of this precious metal. Lack of ordinary care given to platinum crucibles and dishes during fusion and ignition operations, inattention to general condition, surface and shape, and failure to ensure preservation from contact with



Left : The use of a boxwood former for re-shaping and preserving platinum ware. Centre : illustration of base-metal contamination caused by standing a hot platinum crucible on an unclean metallic surface. Right : illustration showing the use of platinum-tipped tongs (note the oxidising flame and the correct distance of the dish from the inner blue cone).

contaminations, all lead to a rapid falling off in efficiency and may even result in complete faiiure after a single fusion.

When premature failure occurs, the chemist may be unable to define the true cause and is apt in his irritation to allocate blame to a fault in the metal.

The following practical hints may serve to obviate, or at least to minimise materially, some of the dangers which are encountered during laboratory use of platinum apparatus.

Phosphorus is the principal contaminant of platinum laboratory ware met with in ordinary analytical practice and it is significant that 0.003 per cent. of this element will produce severe embrittlement and render a vessel quite unusable. Contamination by phosphorus invariably occurs during the ignition of phosphate precipitates or compounds, when free access of air is not permitted; filter paper and other organic material when in contact with such substances should be burned off almost completely, preferably in front of a hot open muffle, before the final ignition is given. It is inadvisable to use a blowpipe to complete the decomposition since reducing gases may come into contact with the contents of the crucible or dish and in any case very high temperatures are rarely necessary for this work. Whenever possible, wide and shallow dishes should be used for the combustion of organic matter to permit of free access of air during the whole heating operation; in this way it will be found that complete combustion is effected in shorter time, and the danger of contamination of the platinum by reduction of reducible compounds may be avoided.

The selection of a suitable material upon which to stand a hot crucible to cool after ignition is generally given too little attention and a high percentage of contamination troubles can be attributed to this source. A clean Vitreosil plate or fire clay triangle is the most efficient of the ready-to-hand materials found in the laboratory for this purpose.

The decomposition of substances in platinum by fusion mixtures such as are required in laboratory practice, is a subject upon which more information should be available. For example, it has recently been shown that the corrosion effect upon platinum by fusion of the mixture of $NaOH : NaNO_3 = 4 : 1$ may be reduced considerably if employed in the proportion of 2 : 1.

It is encouraging to note, however, that manufacturers of platinum apparatus are realising the importance of making available to users the results of many years of experience in the care and maintenance of laboratory platinum ware, and it is conceivable that adjustments of the proportions of a number of standard fusion mixtures as shown above or the addition of another constituent to the mixture may substantially reduce attack upon platinum vessels, while not affecting appreciably the fusion properties of the mixture.

The most effective acid cleaner of platinum is potassium bisulphate, which in the fused condition has a vigorous solvent action on most surface impurities. Cleaning by fusion with sodium carbonate is sometimes necessary and should always be followed by treatment with hot hydrochloric acid. Boxwood containers and formers made accurately to the shape and size of all the usual pieces of platinum ware, are invaluable in removing dents or other like imperfections, and at the same time ensure against mechanical damage when not in use.

SILVER-BEARING SAND IN WATER STERILISATION

A Moscow chemist named Moissejew has been experimenting with the possibilities of the use of silver-bearing sands as a means of sterilisation of water. It has been found by Moissejew recently that the oiligodynamic action of the silver in a silver-bearing sand filter was quite sufficient to render the water sterile under certain conditions. In the first place, it is necessary for the sand to be in two separate layers and for air to have access to it. Further, a two-hour contact between the water and the silver-bearing sand is necessary. Sterilisation is much less effective when the water contains too high a percentage of organic substance; the maximum for easy sterilisation is about 20 milligrams per litre of water. Ammonia and sodium chloride in the water also interfere with sterilisation by fixing the silver ions. The allowable maxima are about 5 milligrammes of ammonia and 15 of sodium chloride per litre.

A NORWEGIAN Government Committee has now approved the proposed plan for establishment of a floating herring oil factory.

B.S. SPECIFICATION FOR WHALE OIL

OWING to the demand by the industries concerned for a specification covering good quality whale oil the British Standard Specification for Whale Oil (No. 836) has just been published by the British Standards Institution. The specification states the various qualities which a good whale oil should possess and gives methods of test by which these qualities can be determined. It is pointed out, however, that the specification does not provide for all grades of whale oil, but, naturally, the methods of test would be applicable to oils of all grades. This specification is the second in the series of British Standards for Marine Animal and Fish Oils now being prepared by the Institution.

Copies may be obtained by application to the British Standards Institution, 28 Victoria Street, S.W.1. (Price 2s., post free 2s. 2d.).

HYDROGENATION of ground-nut oil under reduced pressure in presence of Raney nickel catalyst on a pumice support was found by R. Escourru (*Bull. Soc. Chim. de France*, 5, 1184) to result in complete conversion of the linoleic acid into oleic acid.

Selecting a Chemical Balance

Factors to be Borne in Mind

IT has been said that science is the art of measuring, and a little consideration will show that there is more than a modicum of truth in this statement. Of all the instruments of precision available to the scientist for the purpose of taking measurements, the balance is without doubt the most important. It plays an important part through all the stages of the chemist's work, and the results of much time devoted to costly research depend upon its accuracy and constancy.

In the balance of to-day we have a precision instrument of the first order—an instrument which has been developed in step with the ever increasing demand for accuracy, sensitivity and speed in weighing operations. Manufacturers' catalogues present a wide range of balances to meet all requirements, and at greatly varying prices, so that the following brief survey of some of the more widely-used models may be of interest, particularly to the prospective purchaser.

British and Foreign Makes

There are several factors which it is well to observe in selecting a balance. First, the question of make, although British-made balances are indisputably equal to, if not superior to, those of foreign manufacture, there still persists a preference, particularly among those of the old school, for

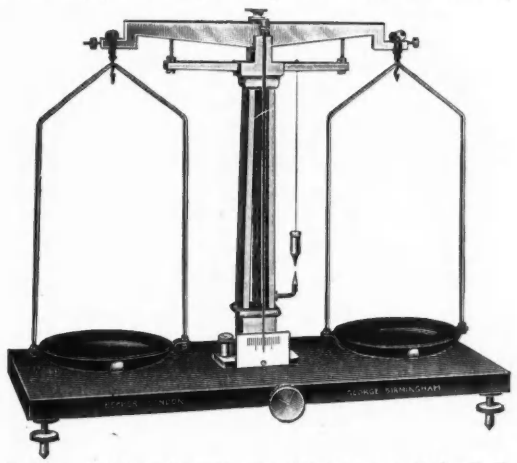


Fig. 1. A " Students " type of balance made by F. E. Becker and Co.

the balances made by two or three foreign manufacturers, whose products have deservedly maintained a reputation for their excellence. In choosing a British-made balance, however, the purchaser has an advantage in that he can quickly get into touch with the manufacturer should anything go wrong. Most British manufacturers have experts who can quickly arrive on the scene to put matters right, and arrangements can usually be made with the manufacturers for a periodic check-up and adjustment of customers' balances.

The Question of Sensitivity

It is not wise to choose a balance of greater sensitivity than is actually necessary for the work it is proposed to do. Greater sensitivity necessarily means a higher initial price, and weighing operations will require proportionately greater care and skill, besides which more frequent overhauling may become necessary.

Similarly, do not purchase a balance unless the period of swing is commensurate with the work intended. Many balances are " damped " to reduce the period of swing. This is accomplished by various means—air damping, oil damping and electro-magnetic damping being the most usual methods employed for this purpose. In many cases the period of swing is so reduced that the balance is rendered direct reading. Thus considerable time can be saved, and this is of importance when a large number of check weighings or routine weighings have to be carried out. Chain-action balances and keyboard-operated balances are also available for the chemist whose time is limited, and these balances also have the advantage that the manipulation of troublesome fractional weights is overcome.

Attention should also be paid to the case of the balance. It should be of ample proportions to give plenty of " elbow room." It should be seen that the front sash is correctly counterpoised, and that it fits properly at the top when closed

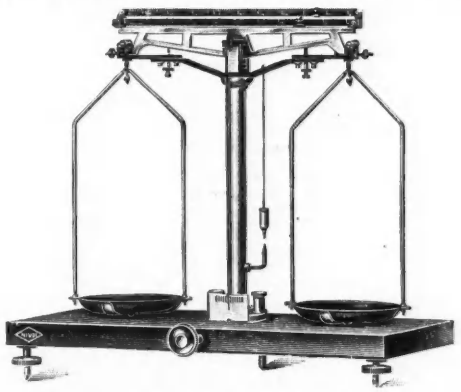


Fig. 2. A " Becker " rider scale balance.

to prevent the ingress of dust and fumes. Side-opening doors are also advisable and the case should have a large area of glass, the top also being glazed to give plenty of light.

The following is a description of some of the more important types of balances available.

Eliminating the Use of Fractional Weights

For all general weighing operations which do not require a high degree of accuracy, the " Students " type of balance such as is used in the elementary laboratories of colleges and schools is suitable. It is robust, and proportionately cheap in price, and has a sensitivity of 2 mg., with a load of 250 gm. (Fig. 1). A development of this type of balance is the rider scale balance (Fig. 2). The use of fractional weights is entirely eliminated by the use of one or more calibrated scales attached to the beam, the position of a sliding rider or riders giving a direct reading. Mention must also be made of the Grainger drum attachment, which can readily be attached to any balance of the "Students" type, and immediately converts it into a chain-action balance, the object of which is, once again, to overcome the troubles associated with fractional weights and to give direct readings.

To pass on to the ordinary chemical balance, mounted in a case. Each manufacturer of repute has a wide range of models and a typical example is shown in Fig. 3. This balance will take a load

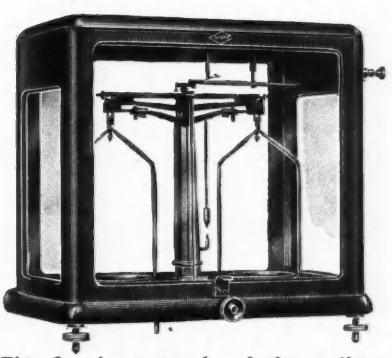


Fig. 3. An example of the ordinary chemical balance. This model is made by F. E. Becker and Co.

of 250 gms. and has a sensitivity of 0.5 mg. Such a balance is suitable for all general laboratory work where speed is not essential, and the prospective purchaser's choice must depend upon the amount of money which it is desired to spend. It is well to remember, though, that a balance is not a mass-produced article, and the manufacturer's listed prices are based upon the workmanship and quality of the materials used in their construction. It is simply a case of the best being the cheapest in the long run.

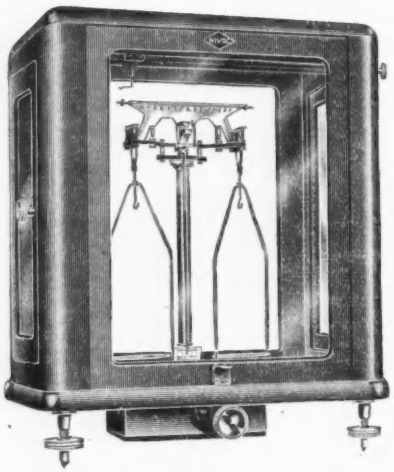


Fig. 4. A "Becker" analytical balance.

This brings us to the many types of analytical balances, and the foregoing remarks regarding quality and cost apply more than ever in this instance. The example illustrated (Fig. 4) is a typical moderately priced analytical balance which is very popular for general analytical and research work. It has a capacity of 200 gm. in each pan, with a sensitivity of 0.1 mg. when fully loaded. It is "undamped" so that it is not a balance suitable for quick weighings, but its accuracy can be relied upon, and further, its simplicity of construction renders it particularly free from the necessity of frequent adjustments—there is nothing much which can go wrong.

The next step is the chain-action balance (Fig. 5). The

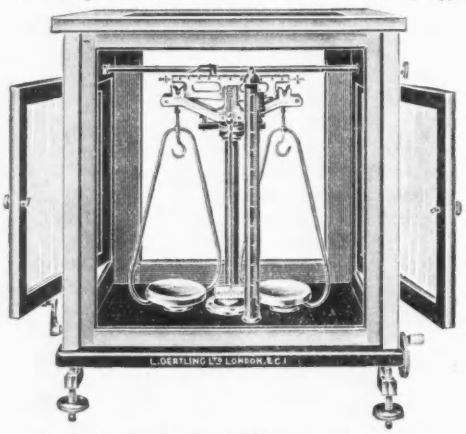


Fig. 5. The "Gram-Chain" balance made by L. Oertling, Ltd., which eliminates the use of fractional weights.

chain column takes care of all weighings from one decigram to one milligram, and readings to 0.1 milligram are obtained by means of a vernier. This balance has a capacity of 100 gms. with a sensitivity of 0.1 mg

Balances with "damping" devices, known as aperiodic balances, are usually provided with a prismatic reflecting index which is illuminated by a low voltage lamp. The image on the index is enlarged, and this method considerably reduces fatigue where many weighings are to be carried out. Such balances are direct reading to four places and fractional weights are entirely eliminated. The balance illustrated (Fig. 6) is typical and has a capacity of 100 gms.

Space does not permit of mention of the many balances designed to meet particular requirements. Micro and semi-micro laboratory technique have necessitated specially designed balances for this class of work. Such balances generally have a capacity of 20 gms. and readings to within 1,000th of a milligram can be made.

In conclusion, it is as well to remember that the balance is one of the most precise instruments available to the chemist, and also one of the most temperamental. It should

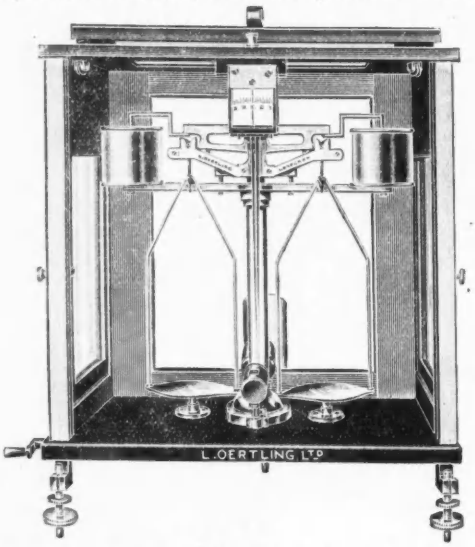


Fig. 6. The Oertling aperiodic, prismatic, reflecting balance.

therefore be treated with the greatest care if its performance is to be maintained. Above all, it should be kept free from dust—a fine camel hair brush being employed for the purpose. It should not be placed close to a source of heat, such as a radiator or drying oven, or in direct sunlight, and the further it can be removed from fumes the better. It is a good idea to cover the balance, when not in use, with a black leather case or a light plywood box. It is to be remembered that the knife edges and planes are usually made of agate, and are extremely brittle, so that the beam of the balance should never be allowed to "bump" down on to its supports. Finally, if anything should go wrong with the balance, it is as well not to attempt to put it right yourself as what may appear to be only a minor adjustment, particularly in the case of a delicate analytical balance, may, if attempted by an unskilled person, result in the whole mechanism becoming thrown out of order.

Hydrocarbon Oils in Soap Solution

Increase of Solubility by Adding Pine Oil

A CONSIDERABLE increase in the solubility of hydrocarbon oils in soap solutions can be achieved by the addition of pine oil, according to experiments reported by Holmes (*Jour. Phys. Chem.*, 1939, *43*, 495-498). Paraffin oils which are, of course, entirely insoluble in water have, it is well known, a considerable solubility in soap solutions. This is "true" solubility; that is, an emulsion is not formed and the solution remains optically clear. When the limit of true solubility is passed, further additions of oil produce an emulsion, and the system becomes turbid.

It has now been found that the limit of true solubility can be still further increased by adding polar oils, such as pine oil, to the paraffin. The effect is more noticeable in concentrated solutions. Thus a solution of sodium oleate containing 20 per cent. by weight of soap, can dissolve 1.6 times its own weight of a mixture of kerosene and pine oil in equal proportions. When the oleate concentration is 33 per cent., the solution can dissolve 1.33 times its own weight of the same mixture. Some experiments were also made with benzene, which has less intrinsic solubility than kerosene. It was found that the greatest solubility increase was obtained when the ratio of water, soap, benzene and pine oil was as 1 : 8 : 8 : 2.

Equipping the Chemical Laboratory

By
W. H. EDWARDS

UNTIL recent years the chemist generally had to be content with a small room in an inconvenient corner of the works, and with poor equipment, the authority for the necessary renewal of which he found difficult to obtain. Much progress has since been made, now that chemical control and research have been found to be a paying proposition, and most firms desire their laboratory to be as up-to-date as possible. With this in view the equipment of a modern laboratory requires some thought of the factors to be considered in the selection and purchase of the necessary apparatus, more especially when an entirely new laboratory is being fitted out. In such cases advantage can be taken of the great improvements that have taken place in the design and manufacture of the working tools of the chemist, which should be of the very best quality, giving accuracy and ease of working combined with the minimum cost.

Factors in Selection

The first factor in the selection should be to obtain the best quality at a reasonable price. It often happens that a list of requirements is prepared giving only general particulars, competitive bids are invited from suppliers and the best price accepted. This method sometimes results in poor quality apparatus, which, although to specification, is likely to spoil work in hand and prove expensive in time and material. Great care should therefore be used in giving exact details when sending out inquiries, or better still where possible a personal selection should be made from the showrooms of a reliable firm of laboratory furnishers. The adoption of the many labour and time-saving devices now available, such as air-damped balances, electrically-heated ovens, baths, furnaces, as well as electrically-driven centrifuge stirrers, etc., should also be considered. The first cost is often repaid in a short while by the saving of time in routine work, thus enabling other more useful work to be undertaken instead. Finally the psychological factor must not be lost sight of, as all concerned take more interest in the work and upkeep of the laboratory, and give better service, if the best equipment is provided.

The following are representative of a few of the more recent developments which have been made in laboratory equipment.

Retort stands, with stainless rods and white vitreous enamel bases, although more expensive, are well worth installing as stands remain in a good condition, and bossheads always slide easily.

Clamps of rust proof aluminium alloy die cast anodised finish are available and these are supplied with stainless brass fittings and cork inserts secured by a special adhesive which is unaffected by steam or reagents. The jaws are arranged to give a secure grip on all articles from 1/16 in. to 3 in. diameter, which makes it practically a universal clamp. Bossheads made of the same material, with single screw action, are also available.

A new design of burette holder recently introduced has two clips into which the burette is easily slipped. The grip opens in front so that none of the graduations is covered.

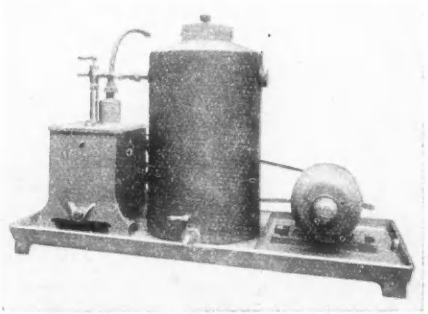
Furnaces

Gas furnaces have the advantage of reaching quickly the desired temperature (up to 1,250 C.). Those designed by the Gas Light and Coke Co. after considerable research, not only heat up quickly but are economical in use, either as muffle or tube forms.

Electric furnaces can now be obtained fitted with automatic temperature control for temperatures up to 1,000° C. The thermostat works on the expansion and contraction of a nickel or nickel-chromium tube, and takes up no more space in the muffle than a thermo-couple stem. One big advantage of automatic control is that when the furnace door is opened the full heating current is switched on to maintain the temperature. In the case of hand-operated control, with the current reduced to the value required to maintain the temperature, opening the door results in a rapid fall in temperature.

Vacuum Installations

The use of vacuum processes in chemical, biological and physical work is now so widespread that a vacuum service is necessary in all modern laboratories. To ensure efficiency, the service must be absolutely reliable and unfailing, capable of maintaining pressures far lower than those attained with water ejectors. In this connection the enormous cost of water used by water pumps is rarely appreciated. Types in everyday use will pass 1,000 gallons per 8-hour day at the usual pressure of 2.8 atmospheres; the cost of water alone (at an average London rate) for one filter pump is 1½d. per



An electrically operated vacuum unit supplied by A. Gallenkamp & Co., Ltd.

hour. The upkeep of the electrically operated unit illustrated, of capacity for pipe line with 24 points, is determined by the power consumption which averages about 200-300 watts per installation and costs about 1d. per hour at the rate of 3d. per B.O.T. unit. There is nothing to wear or break with the vacuum unit; most gases and vapour are trapped before they reach the pump, thus necessitating only an infrequent change of oil.

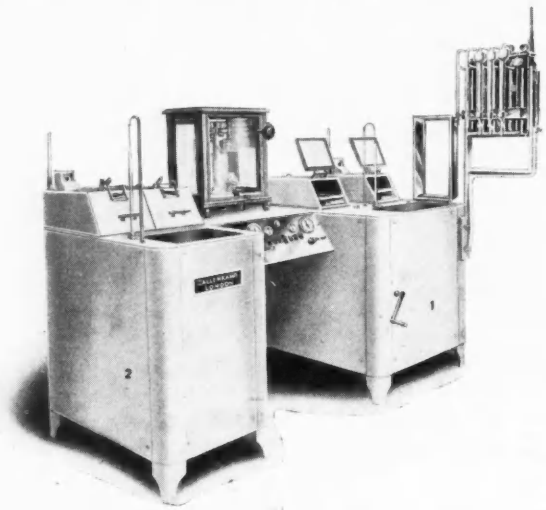
Instead of a fixed unit with pipe lines, various types of rotary oil pumps with stopcock and gauge can be mounted up on a trolley at bench height with rubber tyred castors for use as a mobile vacuum unit, which can be placed adjacent to the working bench.

Vacuum drying ovens are invaluable in analytical and food laboratories for quick moisture determinations and tests where the temperatures of ordinary ovens damages the sample. Typical of these is an oven cast in pig iron, finished in white enamel and fitted with automatic temperature control between 60 and 135° C. ±1° C. The door is precision ground and a vacuum of 26 in. can be obtained without grease.

Test Units

An example of modern time-saving equipment is seen in a self-contained unit designed for rapid determinations, with speed and accuracy, of the percentage of fats and total solids in food products, by the modified Röse-Gottlieb method. The unit has an easy-clean finish of white and chromium, and is free from noise and vibration. The complete unit consists of vacuum ovens, centrifuge and air damped balance, etc., and is so arranged that one operator seated in the centre has all the necessary apparatus and reagents easily to hand, and can

carry out the work with the minimum of fatigue and delay. A full description of the essential features and details of the determinations of fat, total solids, and moistures in milk



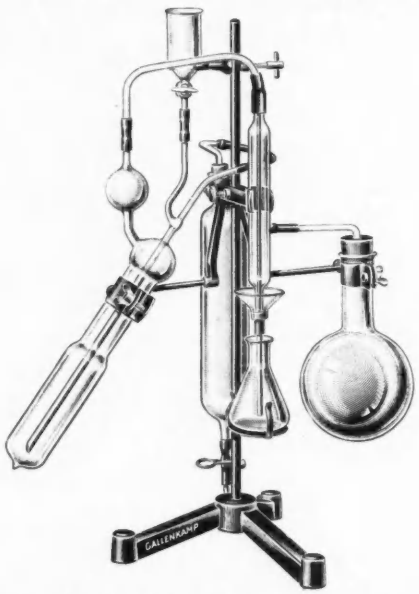
The " Technico " self-contained unit.

products and other foods, will be found in " Fat, Total Solids and Moisture," Determinations by the " Technico " Tester, by R. D. Mason, M.Sc., A.I.C.

Micro- and Semi-Micro Methods

Although considerable work has been done at University laboratories with micro- and semi-micro methods; the advantages of quickness and accuracy are now being more generally realised by industrial chemists. For instance in the micro-Kjeldahl distillation apparatus with Parnos-Wagner automatic discharge arrangement, the distillation occupies only 3-4 minutes. In the electrically heated mortar, recently modified by H. Kirby, the previous disadvantages have been eliminated, as the boiling liquids have been replaced by mercury, which acts as a conductor and also operates the temperature regulator.

The accuracy of graduated glassware is now recognised to be of great importance. It is supplied in grades known as A, B and C; the A and B qualities are supplied to N.P.L.



A micro-Kjeldahl distillation apparatus.

accuracy either stamped or with makers' guarantee, while the C grade is the ordinary commercial quality, and not to be relied on for analytical work. Most laboratories keep a set of N.P.L. stamped instruments for special work and to keep it apart from ordinary glassware the teak cabinet illustrated was designed.

Training for Management

Informal Discussion at B.C.P.M.A. Annual Dinner

THE annual dinner of the British Chemical Plant Manufacturers' Association was held at the Trocadero Restaurant, London, on Thursday, April 20, Mr. J. W. Wright (chairman of the Association) presiding. After dinner, MR. H. WARD gave an address on " The Training for Management of Chemical Engineering Works." In introducing Mr. Ward, the chairman pointed out that as secretary of Management Research Group No. 1 he was employed by twenty of the largest and best known companies in this country, spending the whole of his time visiting plants and discussing management matters with directors and executives.

MR. H. WARD said he would probably be asked what was management and his answer was that it was the quality which kept a concern going and made profits. One of the most important qualities of a managing director was the art of thinking impersonally so that he could get on with all kinds people.

There were a number of new techniques which were not yet common knowledge. They were the techniques of handling personnel, time and motion study, job analysis, budgetary control, costing and planning and management, and perhaps the first question which would be asked was how anybody could train themselves for management. A senior man who had never really studied management as such, could read books but, generally speaking, these would be of little use. A number of Universities had courses in management and a great deal of attention had been given to this side of the problem in America, but the academic people at Harvard, where there was an excellent School of Administration, had to admit that they had not yet succeeded in turning out from the University men who were really capable managers from an industrial point of view. In his opinion, we had not yet solved the problem of the Universities as regards the managing director or manager.

One thing which anybody concerned with management should do was to try and study the problems of other companies, but before doing so they should endeavour to get a very clear idea of the nature of any company they wished to study and its management structure. With that knowledge and some idea of the nature and volume of work being turned out, it was possible to learn a great deal which could be put to advantage in one's own concern.

So far as business management consultants were concerned, these played a very useful part in the industrial structure, but he wished to give two warnings in this connection. First of all, the job which the management consultant was to do should be clearly limited, for in that way greater efficiency was obtained and a less fee paid. Secondly, unless the executives were anxious to have a consultant in, the results were not likely to be very good.

Another way in which people could be trained in management was to change their jobs with the idea of giving a man the widest possible experience. Mr. Ward said that management was, in the end, common sense, but it was necessary

that every department should work in close collaboration.

MR. E. V. EVANS (chairman, Association of British Chemical Manufacturers) said he did not know that he was a fit and proper person to start this discussion, because although he happened to be the general manager of a London gas undertaking, he did not ever remember having been trained for it. He frequently had to look round a rather large staff of some 8,000 employees to try and find those who had in them the possibilities of management, and as one got older one seemed to be able to point direct to those people. It was not necessarily that they had profound knowledge but there was something that could be seen and, having seen it, the first thing to do was to throw these people into the water and make them swim. That had been very much the position in his own case. He did not think there was very much to be learned from training courses because his experience had been that the only things one really knew were those which one had ferreted out for oneself. Frankly his own view was that managers could not be trained. A man was either a manager or he was not.

MR. HAROLD WHITEHEAD said he naturally did not like what Mr. Ward had said about consultants and suggested that the better plan, instead of endeavouring to get ideas on many subjects from a consultant, was to employ a specialist on a particular subject, pay extra and get a little more knowledge! Commenting on the remarks by Mr. Evans he said that there were outstanding men in administration, but there were not enough of them to go round, and that was to be seen in the manner in which some of our industries were run. What, then, was to be done? Were we to accept this defeatist attitude and say that because there were not enough we should have to do the best we could, or were we to try to find out if there were principles of administration which could be studied and learned so that men of average intelligence could acquire a knowledge of, and a capacity for, management, not of course equal to that of the genius, but certainly much better than if he did not have these rules and principles placed in front of him. He was strongly in favour of training young men in administration. At the very worst it could not do any harm to know how other people did things and if a young man had the flair for management he would be a better manager because of that training and breadth of experience.

MR. F. HERON ROGERS said he had found that the qualities which were necessary to fulfil the functions of management in any form really depended, in the beginning, on the innate self of the man. A manager must be a man in the full sense of the word and if he were not, then he ought never to be a manager. These natural qualities could be enhanced by continual education but that in itself was not sufficient. However, he did not think this country was in any way deficient in the right type of young men for management. It seemed to him that the essential qualities of management were more inherent than was generally believed. With regard to consultants, Mr. Rogers said the impression given by Mr. Ward was that the firms engaging consultants should suck their brains and get all that was possible out of them for a minimum payment, but personally he regarded that as a very mistaken policy. If a firm was on the wrong lines and a consultant remedied the position, then the firm should be only too pleased to pay an adequate fee.

On the motion of MR. G. S. WHITHAM, the chairman was heartily thanked for presiding.

MR. B. L. BROADBENT, proposing a vote of thanks to MR. DAVIDSON PRATT, secretary of the Association, said his firm was a member of one of the Management Research Groups and had found the exchange of information with regard to their undertakings and methods of management and production of the greatest possible value.

Among others present at the dinner were: Mr. F. Broadbent, Dr. W. Cullen, Mr. M. B. Donald, Mr. K. Fraser, Dr. R. Lessing, Mr. J. H. G. Monypenny, Mr. B. N. Reavell, Mr. J. A. Reavell, Mr. W. Russell, Mr. F. Sproxton, Dr. A. J. V. Underwood, Mr. I. E. Weber and Mr. H. E. G. West.

The Chemistry of Vitamin E

Papers Presented at Nutrition Panel's Conference

THE first session of the conference on Vitamin E held by the Nutrition Panel of the Food Group of the Society of Chemical Industry last Saturday was devoted to the chemistry of vitamin E. Abstracts of the papers presented at this session follow:

Synthetic Analogues and Homologues of Vitamin E and the Stability of Tocopherol and Tocopherol Esters. By Professor P. Karrer (Professor of Chemistry, University of Zurich) and Dr. F. Bergel (Roche Products, Ltd., Welwyn).

The vitamin E activity of monoalkyl ethers of duroquinol was discussed. It was mentioned that the phytol and dihydrophytol ether of duroquinol were synthesised and compared with tocopherol. The differences in physical and chemical properties has led to the conclusion that tocopherols must be derivatives of coumaran or chroman. In order to find out the chemical specificity of vitamin E activity, the substituents in the benzene ring of the tocopherol molecule were varied and the side-chain was altered. It was shown that a certain number of methyl groups in the benzene ring have to be present and that the alteration of the tocopherol side-chain destroys vitamin E activity. The instability of tocopherols in autoxidation experiments and their behaviour in light were discussed. The preparation of tocopherol esters was described and these compared with tocopherol from the biological and physico-chemical point of view.

Determination of Tocopherols

Chemical Tests for the Tocopherols. By Dr. A. Emmerie and Dr. Chr. Engel (Laboratory of Hygiene, University of Utrecht).

A method for colorimetric determination of tocopherols was described. The reaction is based on the reducing properties of tocopherols towards ferric chloride. The ferrous salt formed is determined with $\alpha\alpha'$-dipyridyl. Good agreement has been found between biological and chemical determination; separation of tocopherols from interfering substances such as carotenoids and vitamin A has been made possible by adsorption with Floridin XS earth. A method for determination of tocopherol in blood serum was described. Administration of tocopherol preparations to Vitamin E deficient rates causes an increase of the tocopherol content of the blood serum. Other methods proposed for the chemical determination of tocopherols were briefly discussed.

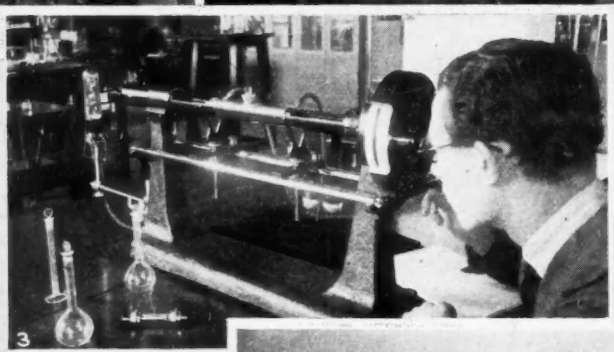
Methods Proposed for the Estimation of Vitamin E Activity. By Dr. E. Lester Smith and Mr. R. Bailey (Glaxo Laboratories, Ltd., Greenford).

Direct ultra-violet spectrophotometry is satisfactory for nearly pure vitamin E preparations only. Electrometric titration with gold chloride (Karrer and Keller) depends on quantitatively oxidising the tocopherols to quinones. Oxidation with excess ferric chloride and colorimetric estimation of reduced iron with $\alpha\alpha'$-dipyridyl (Emmerie and Engel) is quicker than electrometric titration with gold chloride (Karrer and Keller) and equally reliable. Carotenoids interfere with both methods.

Oxidation with alcoholic nitric acid to give a pink colour (Furter) does not discriminate between tocopherols and their oxidation products; the yellow colour developed by many other substances may interfere with the colorimetry. Fairly good agreement has been obtained between biological and oxidative methods of estimating the vitamin E activity of concentrates (unsaponifiable matter). On the other hand, biological values obtained on samples of wheat-germ oil are frequently higher than those obtained chemically, after saponification, and the difference does not appear to be due to losses during saponification.

The two other sessions of the conference were concerned respectively with the physiological action of vitamin E, and the clinical and veterinary uses of wheat germ oil and vitamin E preparations.

SOME PRESENT-DAY LABORATORIES IN



1.—Alkali Group laboratories of Imperial Chemical Industries, Ltd., at Winnington: General view of the analysis laboratory. 2.—The main analytical laboratory of B. Laporte, Ltd., a part of the company's modern laboratories which were opened just over two years ago. On the bench running along the side of the laboratory on the left are a pyrometer (Foster Instrument Co.), a gas oven (Gas Light & Coke Co.) and an electric oven (Wild-Barfield Electric Furnaces, Ltd.). 3.—A polarimeter in the analytical research laboratories of The British Drug Houses, Ltd. The instrument is used for determining, among other things, the optical rotatory value of alkaloidal salts. 4.—Part of the general research laboratory of B. Laporte Ltd. The titration bench at the far end of the bench on the right-hand side is an interesting feature. The benches are of teak, the ends being made of Ruabon tiling in acid proof cement. 5.—A general view of the analytical laboratory of Pilkington Brothers, Ltd., opened last autumn. Here routine analysis is made of all kinds of glass from the furnaces, and also of the fuels used in the manufacture.

THE CHEMICAL & ALLIED INDUSTRIES

6.—Experimental rubber mixing and compounding laboratory of the Dunlop Rubber Co., Ltd., at Fort Dunlop. 7.—The development laboratory of the Anglo-Iranian Oil Co.'s research station at Sunbury-on-Thames. In this laboratory new processes, generally originating in the research laboratory, are developed on a miniature industrial scale before they are transferred to the refinery. 8.—Part of the dyehouse extension of the Clayton Aniline Co., Ltd., Clayton, Manchester. In the section shown above, manufactures are checked for strength, shade, etc. 9.—The heat resisting materials laboratory at the works of the Mond Nickel Co., Ltd., at Birmingham, showing a Bash & Harsch testing equipment. 10.—The paint laboratory of National Titanium Pigments, Ltd., part of the general laboratories of B. Laporte, Ltd. On the bench against the wall are seen, from left to right, two cone mills for paint grinding, one triple granite roll and one edge runner (all by Sydney Smith) and pebble ball mills (Steele Cowlishaw). 11.—A section of the physical testing laboratory at the works of Bakelite, Ltd., Birmingham. In the foreground is seen a series of Izod impact testing machines, while on the right is the high voltage testing equipment and high frequency apparatus.

The Five-Day Week

Benn Brothers Ltd., Celebrate the 21st Anniversary of a Great Reform

LORD LOTHIAN, whose appointment as British Ambassador to the United States is announced, was the chief speaker at a Luncheon given by the Directors of Benn Brothers, Ltd., the proprietors of THE CHEMICAL AGE, at the Trocadero Restaurant, London, on April 21, to celebrate the 21st anniversary of the Five-day Week introduced by the firm in April, 1918. Sir Ernest Benn, the Chairman of the Company, presided over a large and distinguished company representative not only of businesses who had also adopted the five-day week, but of public life and industry in the widest sense.

How the Five-Day Week was Introduced

SIR ERNEST BENN, in submitting the toast of "Our Guests," said that 21 years ago war demands had reduced the firm's staff from 250 to 80. They had recalled all the pensioners, and the staff consisted of 60 women and 20 old men. One day he was passing the Gladstone statue in Aldwych, and saw there a great crowd of girls and city workers. On the base of the statue, under the shadow of the Grand Old Man, he saw a fine figure of a woman, dressed in the breeches and other uniform of the new Women's Land Army. It was his own sister, with at least half-a-dozen of his staff in the crowd. At the time he ventured the thought that the maintenance of the taxpayer was, perhaps, as essential for the winning of the war as putting women into breeches.

It was almost as an afterthought that they closed on Saturday, and so introduced the five-day week. It was not like Monsieur Blum's 40-hour week. They had no conferences, no agreements, no universal panacea, but the introduction of the five-day week was an example of old-fashioned paternal despotism. They put everything they knew into the hours between 9.30 and 6 every Monday to Friday, and they enjoyed a couple of days' complete respite from that drive.

Proceeding to express gratitude to the many distinguished and busy people who were present to give them their blessing and encouragement, Sir Ernest Benn referred to the Latin Grace which had been said by the Master of the Temple. He added amid laughter:—"How happy he must be that he is in England to-day, and not in Rome, where, under the new order of things, he would have to adopt the version, *Benito Benedictator*." Then, they were honoured with the presence of Lord Snell, who might be described as one of the brightest feathers in their democratic cap. Lord Snell seemed to him to prove the truth, in his own charming personality, of the saying that "while every sinner has a future, every saint has a past." Mr. Arthur Hacking's firm, Bryant and May, Ltd., had beaten Benn Brothers by some few months in the establishment of the five-day week. He had succeeded in the more difficult task of applying that principle to a great industrial staff and organisation.

Tributes to Guests

Sir Ernest Benn went on to say that, if the luncheon were a conference on how to put five days' work into every seven days of the week, he could better understand Lord Hankey being there. Lord Hankey might possibly possess a clock but, as long as he had known him, he had never worked to it. Another curious example was Sir Thomas Barlow. For 93 years Sir Thomas Barlow had practised a seven-day week, with a night or two in addition to keep his hand in. Then, there was Mr. Frank Pick, who was believed to be the busiest man in London. For some years he (Sir Ernest) and a committee had been trying to arrange an appropriate memorial to King George V. They had found a site which pleased everyone but Mr. Pick, London's traffic dictator, who in a couple of letters to *The Times* had said that the memorial would be out of harmony with his own Epstein memorial at St. James's Park. (Laughter.) Finally, he came to Lord Lothian, whose list of good works was almost as long as his lineage. With all his responsibilities in public life, Lord Lothian had earned the title of "lubricator in chief" in this world of friction.

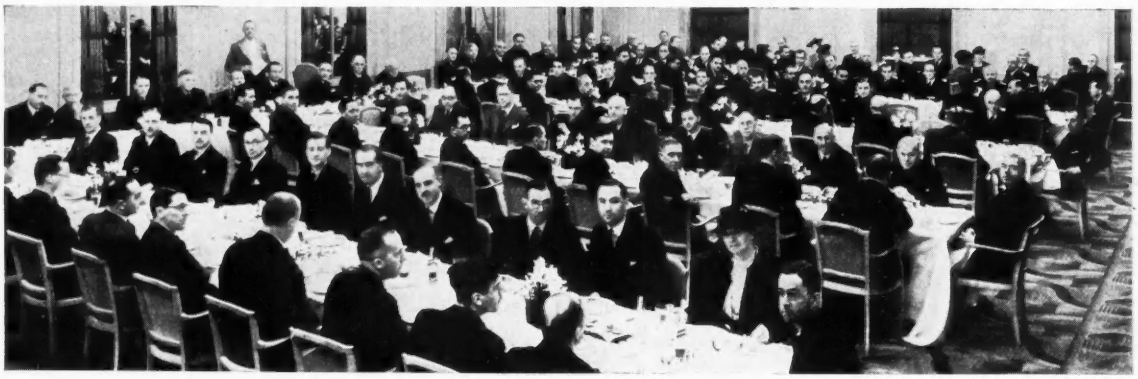
LORD LOTHIAN replied to the toast and referred to the Rhodes Trust, of which he is Secretary. He thought that the Trust had inaugurated a five-day week before Sir Ernest Benn had. Their staff at that time consisted of three young ladies and an accountant, but they had started the five-day idea in exactly the same kind of way as Benn Brothers seemed to have done. Turning to Sir Ernest Benn, he said that no man had done more for the individual and social welfare of this country. Every member of the Benn family had written to *The Times* except Sir Ernest's youngest daughter, Julia. When Sir Ernest's correspondence to *The Times* became more than usually arduous, he started the five-day week in his business, so as to give himself time to ensure that Monday's *Times* should always have a long and carefully prepared article from himself. (Laughter.) He ventured to think, however, that Sir Ernest's motive in inaugurating the five-day week had been a little more public-spirited than had appeared.

It was the normal and natural development of modern machinery, and machinery properly used led to cheaper prices for the community at large, a higher and more varied standard of living, and shorter hours for the workers. As a result of machinery, the standard of living at the beginning of the War was just four times what it had been a century before. In 1800, hours of work in factories in this country were up to 16 per day. In 1819, for the first time legislation was introduced limiting the hours of work to 12, but only for those under 16 years of age. Then in 1837, the limitation of hours to 12 was extended to those under 18 years of age, but it was not until 1844 that women were forbidden to work for more than 12 hours a day. The period between 1847 and 1874 represented a long, determined struggle for the establishment of the 10-hour day, which Parliament introduced in 1874. In 1919 they had the Washington Convention, which set out to bring about a 48-hour week if possible. Now a new idea had been set before the industrial world, the 40-hour week.

The Ideal of the Five-Day Week

Lord Lothian said he thought that the five-day week ideal was to do as much work in the five days as one had done in the original 5½-day week. There was an overwhelming consensus of opinion that one did get as much, and sometimes more, into these five days as one used to get into the 5½ days. The advantages were pretty obvious, both to employer and employee. In the case of the workers, one noticed far better health and vigour and less over-tiredness. In his two free days, the worker was able to apply himself to recreation instead of merely to rest. He employed the two days intelligently and usefully, and did not regard them just as an opportunity for lying an extra morning in bed.

The advantages to employers were seen in less absenteeism, more regular attendance, greater punctuality, and more readiness and quickness in starting on Monday morning. The five-day week meant more and better work in the vast majority of cases. One firm had expressed the opinion that they now got as much work done in 42½ hours as they used to get done in 47 hours. Then it also avoided waste in the way of lighting, heat, etc., which was often a costly matter when used and generated for a half-day on Saturday. This also applied to the running of machinery and plant, which, under the five-day week, was able to be overhauled and cleaned on the Saturday. But there were, of course, certain employments to which the system could not be applied. Like every



The guests at the luncheon given by Benn Brothers, Ltd., to celebrate the 21st anniversary of the introduction of the five-day week.

other reform, one could not apply it universally, but firms who had adopted it were almost uniformly of the opinion that they had benefited, and under no circumstances would they go back. In England, both employers and employees liked it; it was found to pay over a great field of industry.

The same was true in the United States. The National Industrial Conference Board reported in 1929 on a selected number of firms who had adopted the five-day week plan. Out of those who worked the five days with the same number of hours as formerly, 3.1 per cent. reported a substantial reduction in output, 52 per cent. reported no change, while 43 per cent. reported an increase. Out of those of the selected firms who worked the five days with reduced hours, 6.4 per cent. reported a substantial reduction of output, 25 per cent. a proportionate reduction, 49 per cent. no change and 19.2 per cent. an increase.

He congratulated Sir Ernest Benn on having launched a most valuable social reform, and extended the best wishes of the guests for the continued success of Benn Brothers, Ltd., and the continuation of the five-day week.

LORD SNELL proposed the toast of "Success to the Five-Day Week," and said that throughout a fairly long life he had rarely worked for less than seven days a week, and for a good many hours a day. The young people of to-day had a much better chance. Continuing, Lord Snell said that it was his privilege to work for some years with Sir Ernest's distinguished father, Sir John Benn, as a colleague on the London County Council. Sir John Benn was one of the pioneers of the human and enlightened policy of the firm which bore his name. In the old days a man had to work for as long as he could stand. The idea which prevailed in the bad old days was that there were plenty of other human beings where they came from, and under that system blessed, creative, consoling work was turned into monotonous slavery that killed the soul. But, fortunately, the time had gone by when it was thought that one could get the most out of a man by working him more. Before the advent of the Factory Acts, it was thought that the longer children worked, the more they would produce.

"An Improvement on Providence"

Benn Brothers, and the firms associated with them in that very human operation of industry, had started a great reform. When the world was created, the Creator worked for six days and had one day's rest. Benn Brothers' five days' work and two days' rest was an improvement on Providence itself; and he thought they were right. The problem of the future was the status of the man. Under the old politics he was regarded as a unit before the ballot box. But under the new dispensation, man was regarded as a creative, living, growing soul. He was a human being, and not merely a unit of production, though it was well to remember the words of Carlyle, "Blessed is he who findeth his work; he needs no other blessing." Increased leisure, properly used, would create bigger and better men. It offered to the individual the opportunity to enlarge his personality. It enriched the common life. It was a wealth of better things.

Better Health for Workers

MR. ARTHUR HACKING, responding to the toast, said that his firm (Bryant and May, Ltd.) were one of the very earliest to adopt the five-day week, some two months before Benn Brothers on February 28, 1918. Also, his firm were connected with one of the country's most vital industries, the timber trade, and Benn Brothers were the owners of the bible of that industry *The Timber Trades Journal*. He could bear testimony to the benefits derived from the adoption of the five-day week plan in their factories. Their records of illness did not go far enough back to form an accurate guide, but their working girls, particularly in London, were immeasurably better in health than 25 years ago.

It was a very great advantage to provide workers with some form of recreation for the two days they were away from work. There were sports grounds at all Bryant and May's factories. In their offices they had not yet found it possible to include the five-day week, but they did it on alternate Saturdays. That the five-day week was, apparently a success in their factories was shown by the fact that in recent years their organisation had gone forward very rapidly. Twenty-five years ago they started a co-partnership and profit-sharing scheme; at the present time 95 per cent. of their employees were shareholders. One day some visitors were being shown over one of their works and, before they left Sir George Paton's office, he said to them:—"If you see any girl who looks as if she does not own the business, kindly report her to me." (Laughter.)

The toast of "The Chairman" was proposed by MR. FRANK PICK. He said that if anybody represented the antithesis of the five-day week, it was the London Passenger Transport Board, against whom the only grievance was that it did not work 24 hours in every day. Sir Ernest Benn and he had several things in common. They were both addicted to writing to *The Times* and they were both individualists. Perhaps they did not think his (Mr. Pick's) individualism was sufficiently sound when he was a member of that socialistic body, the London Passenger Transport Board. Benn Brothers was becoming an institution. In time it would be very much in the same category as the London Passenger Transport Board; all their efforts seemed to be driving in that direction. They were celebrating that day a very trivial adjustment of the working week, a mere beginning of things.

In addition to the speakers and the directors and heads of departments of Benn Brothers, Ltd., the following were among those present:—Sir Thomas Barlow, Mr. Wedgwood Benn, M.P., Mr. G. C. Clayton, of Incandescent Heat Co.,

Ltd., Mr. T. W. Coghlin, of The British Commercial Gas Association, Mr. Graham Cunningham, of Triplex Safety Glass Co., Ltd., Mr. J. Dagley, of Burgess Zeolite Co., Ltd., Captain Norman Dore, of Baldwins, Ltd., Mr. P. C. Drake, of Price's Patent Candle Co. Ltd., Mr. H. C. Edgell, of Milton Proprietary, Ltd., Mr. F. L. Halford, of Shell-Mex and B.P., Ltd., Lord Hankey, Sir Patrick Hannon, M.P., Mr. Clifford Harrison, of Horlicks, Ltd., Mr. C. H. Heinlein, of Darwins, Ltd., Mr. Robert R. Hyde, of the Industrial Welfare Society, Mr. Frank Jones, of The South Metropolitan Gas Co., Mr. J. Kemp-Welch, of Peter Brotherhood, Ltd., Mr. B. E. Kent, of Allen and Hanburys, Ltd., Commander Phillip W. Kent, of George Kent, Ltd., Mr. W. Lloyd Willey, of Thomas Hill-Jones, Ltd., Mr. L. P. O'Brien, of B. Laporte, Ltd., Mr. J. W. Pearson, of British Oil and Cake Mills, Ltd., Mr. Renny Pinkney, of Caird and Rayner, Ltd., Mr. F. E. Priestland, of Cooper, McDougal and Robertson, Ltd., Mr. J. A. Reavell, of Kestner Evaporator and Engineering Co., Ltd., Mr. C. J. Rose, of Scott and Browne, Ltd., Mr. Charles Shippam, of C. Shippam, Ltd., Mr. R. J. Turner, of C. C. Wakefield and Co., Ltd., and Mr. J. P. Van den Bergh, of Lever Brothers and Unilever, Ltd.

Chemical Matters in Parliament

Oil from Coal

IN the House of Commons last week Mr. James Griffiths asked the Secretary for Mines what further measures had been taken to promote research into the problems of extracting oil from coal, following upon the report of the Falmouth Committee; and whether any steps had been taken, or were contemplated, to establish a plant to develop the Fisher-Tropsch process in this country.

The Secretary for Mines (Captain Crookshank) referred Mr. Griffiths to a reply given in the House on March 14 in which it was stated that the principal recommendation of the Falmouth Committee was that Government assistance to oil from coal should take the form of a continuation of the guaranteed preference and effect to that which was given in the Finance Act, 1938. The Government did not grant direct financial assistance to oil from coal schemes apart from assistance for which such schemes might qualify under the Special Areas Act.

Mr. Griffiths: Have the Government made any proposals for the purpose of carrying out the recommendations of the report?

Captain Crookshank: No, Sir. That rests with private enterprise. What the Government did was to carry out the principal recommendation by extending the guaranteed preference under the Finance Act last year.

Calcium Carbide

Mr. Ellis Smith asked the President of the Board of Trade in the House of Commons on Tuesday if he was aware that approximately 60,000 tons of calcium carbide was imported annually into this country; that the need was on the increase in view of the growing need for carbide, certain chemicals, plastics, and material for manufacturing high-speed cutting tools; and would he take action in order that the manufacture of carbide and ferro-alloys could be carried on in this country, and treat this matter as one of urgency.

Mr. Cross, Parliamentary Secretary, Board of Trade, replied that he was well aware of the uses to which calcium carbide and the plant for making calcium carbide can be put. But the House had on more than one occasion rejected the Caledonian Power Bill, which was designed to develop hydro-electric works to provide cheap current for carbide production; and while his right hon. friend would welcome any well-considered plan for setting up a factory in this country, he had no powers to intervene with private enterprise. The provision of Government factories was not in contemplation.

PERSONAL NOTES

SIR ALBERT BENNETT, Bart., has been appointed chairman of the board of directors of the Anglo Metal Co., Ltd., in place of the late Mr. Ernest E. Marshall.

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MR. STEPHEN JOHN ROBERTS has been appointed chemist at the Leicester City sewage farms, succeeding MR. J. A. CHRISTIAN, who after eleven years in the post, has left to be chief sewerage engineer and manager at Preston.

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MR. J. W. WRIGHT was elected chairman of the British Chemical Plant Manufacturers' Association at their annual general meeting on April 20. MR. B. L. BROADBENT was elected vice-chairman and MR. W. S. KNIGHT honorary treasurer.

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DR. C. J. PEDDLE was re-elected president of the Society of Glass Technology at the recent annual meeting. PROFESSOR W. E. S. TURNER was re-elected hon. secretary, MR. F. G. ORME, hon. treasurer, and MR. F. C. FLINT, American treasurer.

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MR. VICTOR BLAGDEN was re-elected president of the British Chemical and Dyestuffs Traders' Association, Ltd., at the annual meeting of the Association on Tuesday. MR. A. F. BUTLER and MR. S. J. C. MASON were re-elected vice-presidents, and MR. A. F. LAWSON was elected chairman.

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DR. EDWARD ARDERN, consulting chemist to Manchester Corporation Rivers Department, has been invited by the Colne Valley Sewerage Board to be a member of a deputation which the board is sending to the United States, to investigate the latest methods of sewage disposal in Chicago and Buffalo.

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PROFESSOR J. C. GHOSH, head of the Department of Chemistry at Dacca University has been appointed permanent Director of the Indian Institute of Science, Bangalore. Professor Ghosh recently presided over the twenty-sixth session of the Indian Science Congress at Lahore. His original work includes investigations into the abnormality of strong electrolytes and he worked for some time in the laboratory of Professor F. G. Donnan at University College, London.

OBITUARY

SIR ERNEST WILLIAM TATE, of Tate and Lyle, Ltd., sugar refiners, has died at the age of 72.

MR. A. D. MACKAY, director of the British Xylonite Co., Ltd., has left £13,158 (net personalty £12,951).

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MR. EDWARD R. BOLTON, chairman and managing director of Technical Research Works, Ltd., and a director of International Plant, Ltd., left estate valued at £30,113 (net personalty £29,121).

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EMERITUS PROFESSOR HENRY LOUIS, professor of mining and lecturer in metallurgy at Armstrong College, Durham University, from 1896 to 1923, has left estate of the value of £16,932 (net personalty £15,086).

TO-DAY'S ANNIVERSARY

ALBIN HALLER, who died on April 29, 1925, was one of the five outstanding workers upon the chemistry of the terpenes. In this connection he may be placed alongside Adolf Baeyer, working in Berlin and Munich, Otto Wallach, in Göttingen, W. H. Perkin, jun., and Gustav Komppa, in Helsingfors. Haller himself worked in Paris. The correctness of the formula first suggested by C. J. Bredt, in 1893, for camphor, received due confirmation by Haller's synthesis of camphor from camphoric acid in 1896, followed by the synthesis of the oxidation products of camphor, namely, camphoronic acid and camphoric acid.

General News——————From Week to Week

PREPARATIONS FOR RESUMING the limestone industry at Chapel, near Kirkcaldy, Scotland, are nearing completion. The mine, which has not been worked for 30 years, was made ready this week. A new kiln has been built of special heat-resisting bricks. Work is being managed by the Charlestown Lime Co., Ltd.

FOUR MEN WERE KILLED at the Burntisland (Fife) works of the British Aluminium Co., Ltd., on April 22, when a 200-gallon tank which they were filling with a mixture of bauxite and caustic soda, exploded. One man was killed by a piece of flying metal and the other three died from severe burns. The men were employed in a department of the works where bauxite and caustic soda are boiled in tanks by high pressure steam.

THE MOST RECENT ESTIMATE of Britain's coal reserves is 200,000,000,000 tons within a depth of 4,000 ft., stated Sir Harold Hartley, chairman of the Fuel Research Board, when addressing the conference at Brighton on Monday of the British Commercial Gas Association. He added that if the rate of output remained constant, the known reserves would last for four to five centuries, while the addition of probable reserves would raise the period to seven centuries.

DEVELOPMENTS AT THE MOSSEND (Scotland) works of Colvilles, Ltd., may take place in the near future. It is reported that the Clyde Alloy Steel Co., Ltd., Motherwell, is arranging to carry out some of its work there. Should this development take place Clyde Alloy will be the fourth concern to start work on the Mossend site. The others include I.C.I., Ltd. Blast furnace plant for Colvilles' Clyde Iron Works' extension at Tollcross, Glasgow, is being supplied by Ashmore, Benson, Peace and Co., Ltd., at a cost of £100,000.

NOTWITHSTANDING THE SERIOUS SITUATION on the Continent the china clay shipments for March show a gratifying increase. The total turnover for the month was 73,157 tons, and a feature has been the improvement in the American and Indian markets. Fowey shipped four thousand tons more than it did in March, 1938, and the local port of Par created a record in the despatch of 16,271 tons. The aggregate tonnage dealt with for the first quarter of the present year is 191,274 tons which, when compared with a similar period in 1938, is an advance of 29,691 tons.

THE ANNUAL PRESENTATION of long-service awards to employees of Imperial Chemical Industries, Ltd., in the Explosives Group at Ardeer took place recently, when there was an attendance of 350 workers and an extensive representation from the management and I.C.I. board of directors. Mr. W. W. Lumsden was in the chair, and the presentations were made by Mr. J. Laing, group chairman. Awards were made to retired employees who had 40 years' service; employees with 40 years' service; employees with 35 years' service; and employees with 25 years' service.

THE USE OF PETROLEUM SPIRIT continues to grow, not only for use in internal combustion engines, but also in the manufacture of numerous articles, such as polish, paint, varnish, lacquers, etc., according to a statement made by Mr. G. B. Cole, chief inspector of the Manchester Weights and Measures Department, in his annual report to the Manchester Corporation. Mr. Cole states also that the number of licences issued in the Manchester area during the year, was 1,339, covering the storage of 1,996,419 gallons of petroleum spirit and mixtures thereof, and 47 tons of calcium carbide. 1,848 visits were paid to storage places, during the course of which 25 infringements of the regulations were disclosed.

A STRONG RECOMMENDATION to the Government that all imported goods which require to be marked with an indication of origin should now carry the name of the country where such goods were made has been put forward by the Federation of British Industries. Under the terms of the Merchandise Marks Act, 1926, overseas manufacturers sending goods to this country could mark them simply "Foreign" (or, if they were made in Empire countries—"Empire"), or indicate the country in which they were manufactured or produced. In view of the changed trading circumstance of recent years, the Federation strongly urge that the Act should be amended to remove the option, compelling those responsible for the goods to give a definite indication of the country of origin.

A RESOLUTION contending that "the rates for the carriage of certain chemicals by rail were excessive, and should be reduced, having regard to the legislative safeguards applied and to the care necessarily exercised in the packing of the chemicals by all reputable manufacturers," has been remitted to the Railway and Transport Committee of the Glasgow Chamber of Commerce by the President's Advisory Committee.

Foreign News

DIFFICULTY IS BEING EXPERIENCED IN JAPAN in obtaining adequate supplies of home-produced acetic acid owing to the shortage of carbide. This has resulted in an increased demand for formic acid.

ALTHOUGH ITALY IS WELL PROVIDED WITH PLANT for the production of calcium cyanamide, actual output has been seriously limited in the past year by the shortage of electric current. The extensive plant of the Montecatini concern at Domodossola was handicapped for this reason, although the concern is going ahead with the erection of still another cyanamide plant in the industrial zone of Apuania. Imports of calcium cyanamide have been of the order of 50,000 tons per annum. In view of the fact that orders have been issued to cut down this figure to 16,500 tons, agricultural users are faced with a serious shortage this year.

THE MINE PRODUCTION of lithium minerals in the United States dropped off sharply in 1938, but this was more than offset by the recovery of lithium from an entirely new and heretofore unsuspected source, as a by-product of the complex brine-refining operations in California—at Searles Lake—which yield potash, sodium sulphate, soda ash, and borax as co-products. The total production of lithium compounds, as given by producers to the Bureau of Mines, aggregated 892 short tons valued at $329,088, compared with 1,357 tons with a value of $36,206 in 1937 and 1,241 tons worth $34,273 in 1936.

DEVELOPMENT OF A SATISFACTORY PROCESS FOR PEAT CARBONISATION is being attempted in an experimental plant at the Physikalisch-Technische Reichsanstalt in Berlin. The principal objectives are the production of low temperature tar as a raw material for hydrogenation and of a low-temperature coke which could be utilised as a reactive solid fuel in generators. Prospects for the development of a peat-carbonising industry are described as promising by Krapf and Schwinghammer (*Chem. Fabrik*, April 12, 1939) who give details of yields and properties of various carbonisation products. The best yields of tar and coke were obtained with a peat from the Bürmos deposits, the water-free material giving 14.55 per cent. of tar and 45.33 per cent. of coke as well as a fair proportion of gas.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—A well-established firm of merchants and agents at Karachi wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of Patent Medicines for Sind, Punjab, Baluchistan, and North-West Frontier Province. (Ref. No. 319.)

Canada.—A firm of merchants and agents established at Montreal wishes to obtain the representation of United Kingdom manufacturers or exporters of drugs for Eastern Canada. (Ref. No. 322.)

Cyprus.—An agent established at Nicosia wishes to obtain the representation, on a distributorship basis, of United Kingdom manufacturers of pharmaceutical specialities for Cyprus. (Ref. No. 325.)

New Zealand.—H.M. Trade Commissioner at Wellington reports that the New Zealand Public Works Department is calling for tenders (Contract No. 926) for the supply and delivery of: Two 12 in. oil filter presses, complete with motor driven pump, etc.; two drying ovens; one oil testing transformer suitable for 230 volts, 50-cycle supply.

Tenders, endorsed "Quotation for filter presses, drying ovens and oil tests," should be addressed to the Secretary, Supplies and Tenders Committee, Public Works Department, Wellington, New Zealand, by whom they will be received up to 4 p.m. on June 20, 1939. (Ref. T. 21424/39.)

Chemical Markets

LONDON.—Conditions in the industrial chemical market have shown very little change during the past week and most sections continue to report a fair amount of activity. Buyers appear to be calling for deliveries against existing contracts with fair promptness and covering quantities which are regarded as satisfactory. There are no important price changes to record for general chemicals, rubber chemicals and wood distillation products values remaining steady at recent levels. Conditions in the Coal Tar market continue more or less as reported last week. A good demand is reported for Toluol and Xylol and values remain steady.

MANCHESTER.—Notwithstanding the uncertainties of the international outlook fairly active conditions have been reported on the Manchester chemical market during the past week and steady to firm price conditions generally obtain. Traders state that fair quantities of most classes of chemicals, including dyeing and bleaching materials, are moving into consumption against contracts, whilst fresh bookings are moderate, some users showing a disposition to add to stocks as a precautionary measure. With regard to the tar products, values of the light descriptions have been maintained and current business in these is more satisfactory than it is in the case of the heavy materials.

Company News

British Tar Products, Ltd., have declared an interim dividend of 4½ per cent., less tax (6¼ per cent.).

J. and J. Colman, Ltd., have declared a final dividend of 10 per cent., and a bonus of 1 per cent., making a total of 16 per cent. for the year (the same).

Reckitt and Sons, Ltd., are maintaining their ordinary distribution at 22½ per cent. for the tenth successive year. A final dividend of 6¼ per cent. and a bonus of 1¼ per cent. has been declared.

Van Den Bergh's En Jurgens' Fabrieken N.V., which is controlled by Lever Brothers and Unilever N.V., report a net profit for 1938 of Fl. 6,550,739 (Fl. 5,626,248). The total "A" ordinary dividend is maintained at 15 per cent., and the dividend on "B" ordinary shares also remains at 8 per cent.

Lever Brothers and Unilever, Ltd., and **Lever Brothers and Unilever, N.V.,** have declared final dividends of 6 per cent., and 4½ per cent. respectively, making totals for the year of 10 per cent. and 7½ per cent. (the same, in both cases as in 1937). Net profits of Lever Brothers and Unilever, Ltd., before appropriations, but after taxation, amounted to £6,319,244, a decrease of £257,073. Net profits of Lever Brothers and Unilever N.V., totalled Fl. 27,083,588 (Fl. 23,217,516). The consolidated accounts of the Lever Brothers and Unilever Group show aggregate net profits of £12,220,607 (£12,749,991).

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

KATALIK, LTD., London, E.C., producers of tar, sulphate, etc. (M., 29/4/39.) April 12, £1,000 debentures, present issue £500; general charge. *Nil. Aug. 25, 1938.

KOPPERS COKE OVEN CO., LTD., Sheffield. (M., 29/4/39.) April 12, charge (created by receiver for debenture holders) to National Provincial Bank, Ltd., securing all moneys due or to become due to the Bank from J. T. Rankin as receiver for the debenture holders of the company; general charge. *£30,000. Dec. 27, 1938.

Satisfactions

BRITISH COLLOIDS, LTD., London, N.W., chemists, etc. (M.S., 29/4/39.) Satisfaction April 11, of mortgage registered May 14, 1934.

PILKINGTON BROTHERS, LTD., Liverpool, glass manufacturers. (M.S., 29/4/39.) Satisfaction April 15, of debenture stock registered May 4, 1925, to extent of £45,000.

Receiverships

HULTON SOAP AND CHEMICAL CO., LTD. (R., 22/4/39.) Ridyard Street, Little Hulton, near Bolton. W. Archer, 78 King Street, Manchester, has been appointed receiver and manager on April 4.

Books Received

Leather Finishes. J. S. Mudd. London: A. Harvey. Pp. 113. 10s. 6d.

Le Soja et les Industries du Soja. Paris: Gauthier-Villars. Pp. 390. 60 Fr.

Colloidal Phenomena. By Ernst A. Hauser. London: McGraw-Hill Publishing Co., Ltd. Pp. 294. 18s.

Economics of Chemical Industries. By Edward H. Hempel. New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd. Pp. 259. 15s.

Chemical and Allied Stocks and Shares

FOLLOWING THE BUDGET SPEECH the industrial section of the Stock Exchange showed a steadier tendency, but there was little, if any, improvement in the volume of business owing to the uncertainty which continues to attach to international politics. Sentiment was assisted to some extent by the absence of an increase in income tax and N.D.C.

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Most shares of companies connected with the chemical and kindred trades were fairly steady, and movements in prices were small and relatively unimportant. Imperial Chemical are 28s. 9d. at the time of writing, compared with 28s. 4½d. a week ago, but the preference units have declined from 29s. 1½d. to 27s. 9d. Fison Packard and Prentice were again a firm feature and have been maintained at 37s. 6d., while B. Laporte shares continued to be held tightly, awaiting the past year's results. Lever and Unilever improved from 32s. to 32s. 9d. xd on satisfaction with the maintenance of the dividend at 10 per cent. which is regarded as a good achievement because the business of the Dutch associated company must have been affected by the political uncertainty on the Continent. Turner and Newall were moderately better at 75s. 9d., while British Oxygen at 73s. 9d. were also slightly higher on balance, as were British Aluminium at 54s. 9d.

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Distillers rallied strongly following an earlier decline, and are 90s. 6d. at the time of writing, compared with 88s. 6d. a week ago, there being growing anticipations in the market that the distribution for the year is likely to be either 22½ per cent. or 20 per cent. United Molasses at 22s. 3d. were little changed, awaiting declaration of the interim dividend. Slightly better prices ruled for Dunlop Rubber and various iron, steel and allied securities also gained a few pence, including Dorman Long and Stewarts and Lloyds. Tube Investments were steady at 85s. 9d., on the assumption that the interim payment is likely to be unchanged. Birmid Industries were fairly active around 54s., and Murex were little changed at 71s. 3d., although now "ex" the interim payment. Babcock and Wilcox have moved up from 39s. 6d. to 41s. 3d. on satisfaction with the increased distribution for the past year, while Hopkinsons shares were also moderately higher in view of the higher dividend payment.

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Hopes of a possible scrip bonus maintained a firm tendency in Boots Pure Drug, and at 40s. 6d. these 5s. shares are virtually the same as a week ago. Beechams Pills deferred shares improved from 6s. 7½d. to 7s. 1½d. on the decision to repeal the medicine stamp duty, and various other shares of proprietary medicine and allied companies were also better. Sangers improved to 20s. 6d., but Timothy Whites and Taylors made the slightly lower price of 23s. 7½d. British Drug Houses continued to be quoted around 21s.

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Textile securities were dull and mostly lower in price owing to the reduced profits reported by English Sewing Cotton and J. and P. Coats, but British Celanese continued to show a somewhat steadier tendency, awaiting the decision as to a dividend on the preference shares.

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Leading oil shares were better in the absence of an increase in the petrol tax. The "Shell" and Royal Dutch dividends, which have been declared earlier this year, created a satisfactory impression as the market is taking the view that there is the possibility of further moderate payments being declared when the results are issued.